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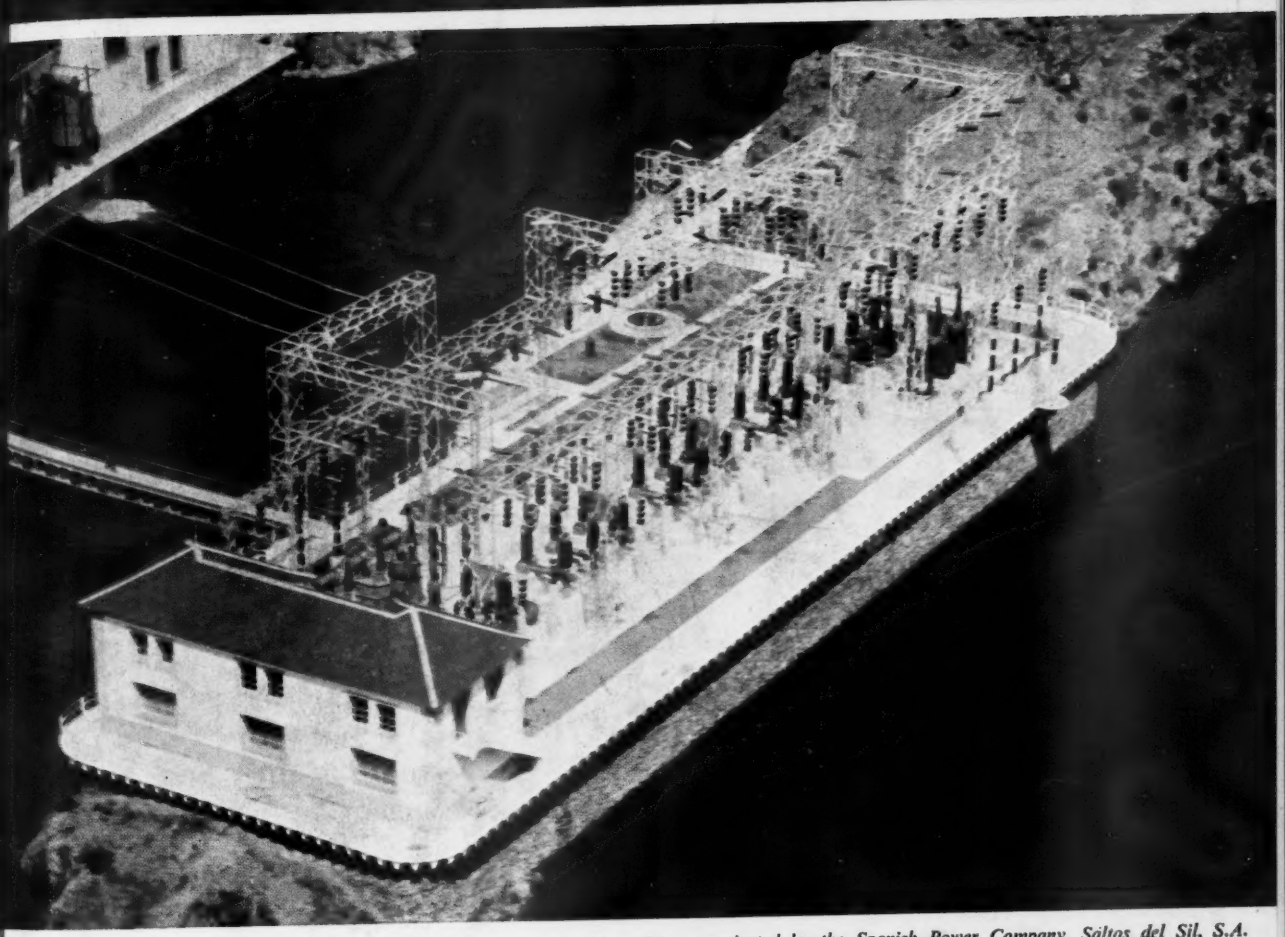
ELECTRICAL REVIEW



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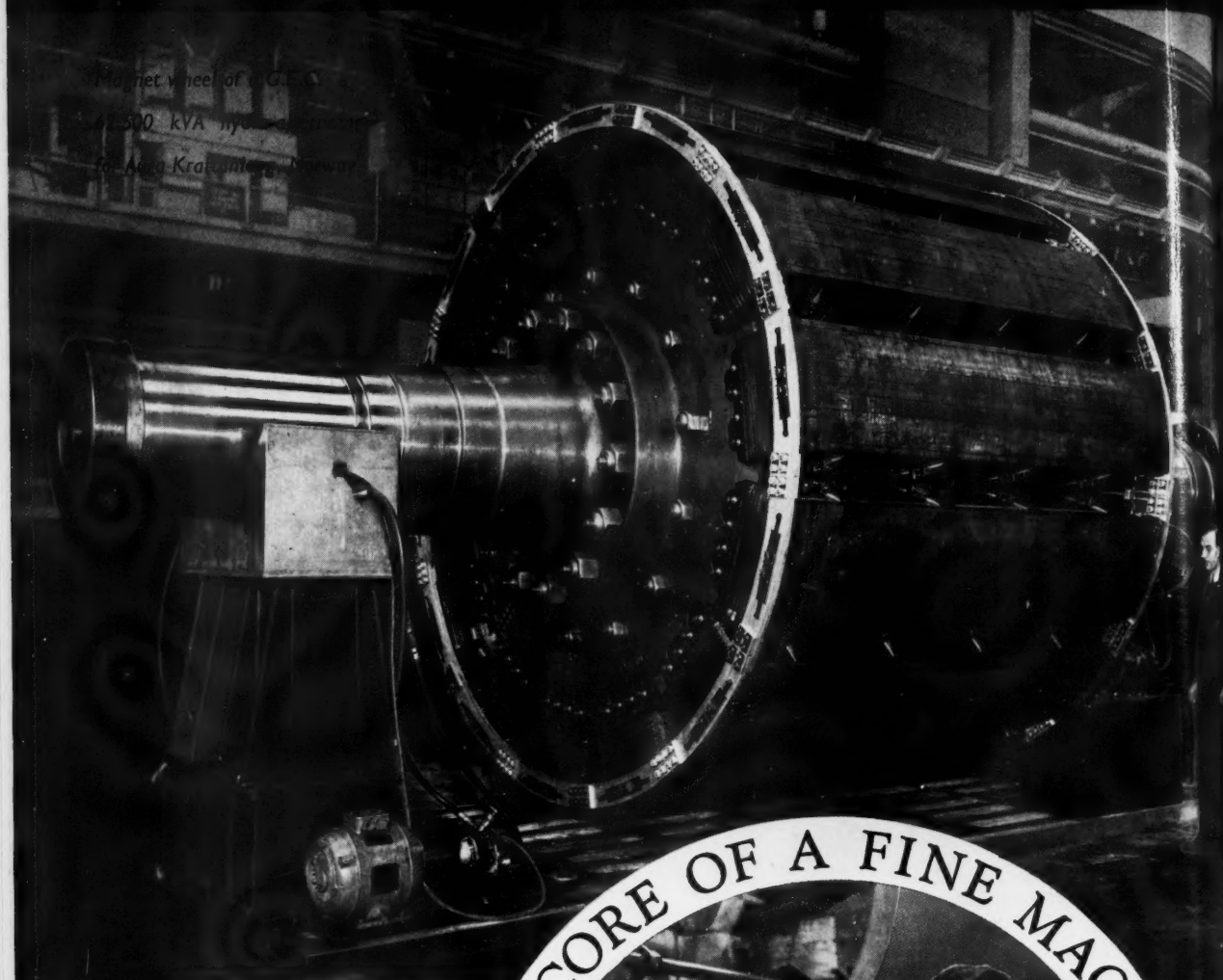

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22 JUNE 1956

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VOLUME 158 ◇ NUMBER 25

Eighty-Fourth Year of Publication

FRIDAY ◇ PRICE 1s 6d

Editorial, Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £4 10s 0d: U.S.A. and Canada $14.00. Cheques and Postal Orders (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

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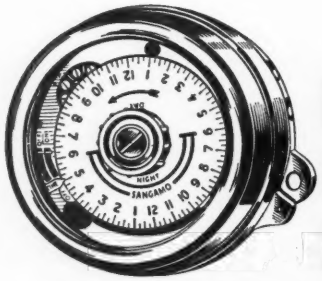

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ELECTRICAL REVIEW

22 June 1956 Vol. 158 No. 25 Established 1872

Taking Stock of Energy

ALTHOUGH estimates of potential sources of energy are continually being revised in an upward direction, the tendency persists for such increments as can be economically applied to be absorbed by ever-growing demands. That this trend is, or will be, common to all countries, whatever their stage of industrial development, has been evident in the discussions at the World Power Conference in Vienna, a report of which appears in this issue.

Prospects of obtaining a sufficiency of energy to meet universal needs in the future have been immensely altered since the last plenary Conference was held in London in 1950. The practical shape given to the concept of producing electricity commercially from nuclear fission at full-scale power stations, as exemplified by the prototype Calder Hall and its projected successors, revives the tradition of this country as a pioneer of practical engineering achievement—achievement that is now backed by a greater appreciation of the value of scientific research and based on experience not far removed from that of the manufacturers' ordinary engineering production.

Several years must elapse before nuclear power stations can altogether replace more conventional kinds (if indeed they ever do) and their advent detracts no whit from the urgency of the drive to install larger individual generating units operating at the more advanced steam conditions requisite for husbanding coal reserves during the twenty-five years of their actuarial life. A novel feature of the large sets now being designed for the Central Electricity Authority is that they are intended for two- or even single-shift operation, indicating a solution of the difficult problems associated with heating and cooling of heavy masses of metal. This procedure, dictated by the economic and technical need to run reactors at as nearly as possible a hundred per cent load factor, in view of their high capital and low running costs, entails a new approach to operating interconnected systems in regard to the allocation of peak loads. This will mean a progressive lowering of load factor for coal-fired and hydro stations and a strengthening of the case for pumped storage.

Another factor for consideration is the great advance made in the high-voltage transmission of large blocks of power from remote sources, as discussed at the C.I.G.R.E. and reported in our issues of 8th and 15th June. The effect of this should be to improve diversity and hence the amount of plant required. The low running cost of nuclear power stations should enable electricity with its efficiency in application and convenience in control to take a much larger share than at present of the industrial heating load, which accounts for about three-quarters of the world's energy requirements.

POWER STATION CONSTRUCTION

When a modern generating station is being designed it is usually possible to plan the layout of the main buildings to suit the plant which is to be installed. In some cases, however, it is necessary for various reasons to erect a generating station on a site which is not entirely suitable for this purpose and it is then that the difficulties start. Portishead "B," which is described in this issue, comes into this category.

This coal/oil fired station accommodates twelve 300,000 lb/hr boilers and six 60 MW turbo-alternators, each pair of boilers being operated with one turbo-alternator as a single unit. The main building is long and narrow (700ft by only 190ft) and this has led to the use of two-cylinder turbines which are much shorter than three-cylinder machines. Incidentally, the sets are prototypes of the 100 MW units to be installed in Castle Donington. The circulating water system also is unusual as the conditions obtaining in the River Severn necessitate reversal of flow characteristics. Furthermore, since the tide range is at times over 51ft the condensers are situated in pits between each pair of machines and connected to the turbines by long steel trunking. This enables full advantage to be taken of siphonic action.

MACHINE TOOL DEVELOPMENTS

The International Machine Tool Exhibition which opens to-day at Olympia, London, follows the course set by the Machine Tool Trades Association (of Great Britain) in organising, every four years, an exhibition in London of the latest ranges of products from the world's main machine tool manufacturing countries. This exhibition, which closes on Friday, 6th July, will be reviewed from the point of view of the electrical engineer in our next issue. The importance of the previous exhibition, held in 1952, was fully appreciated, coming as it did when the manufacturing industries in many countries were going through a period of post-war rehabilitation.

The present exhibition, which is the third to be held since the war, is even more important for it is not only the most comprehensive display of machine tools and allied equipment to be held in Europe this year, but it is being held at a time when competition is growing in international trade and when the principles of automation are becoming more widely understood. From advance information concerning the exhibits it is evident that since the last exhibition there has been rapid development of automatic handling methods.

Electronic controls are also being more widely used and machine tools generally are being more robustly constructed with higher installed horsepowers to meet the need for increased cutting speeds. Furthermore, increasing attention is being paid to the application of the copying principle, both by built-in equipment and the use of external attachments. Other developments to be seen at Olympia include mechanical and electrical equipment for measurement and control and increased accuracy in form and repetition of size.

E.C.A. CONFERENCE

From Sunday to Tuesday next the Electrical Contractors' Association is holding its annual conference at Eastbourne under the presidency of Mr. R. A. Marryat, B.Sc.(Eng.), A.M.I.E.E. A full illustrated report will appear in next week's issue.

ELECTRICAL ENGINEERS' EXHIBITION

It was apparent at last week's meeting of exhibitors at the Electrical Engineers (A.S.E.E.) Exhibition that there is general acceptance of that display as a regular annual event. Such criticisms as there were appeared to be of a relatively minor nature. There were the usual complaints about the catering arrangements, but the main fear expressed was that the expansion of some of the larger stands in the central section would tend to force some smaller concerns out of the picture or up to the first floor. It was admitted, though, that if the first-floor display which is being arranged for next year could be made sufficiently large and attractive there would be no grievance. Nevertheless it would be a pity if some of the larger companies over-dominated a show which was originally designed to give equal opportunities to all.

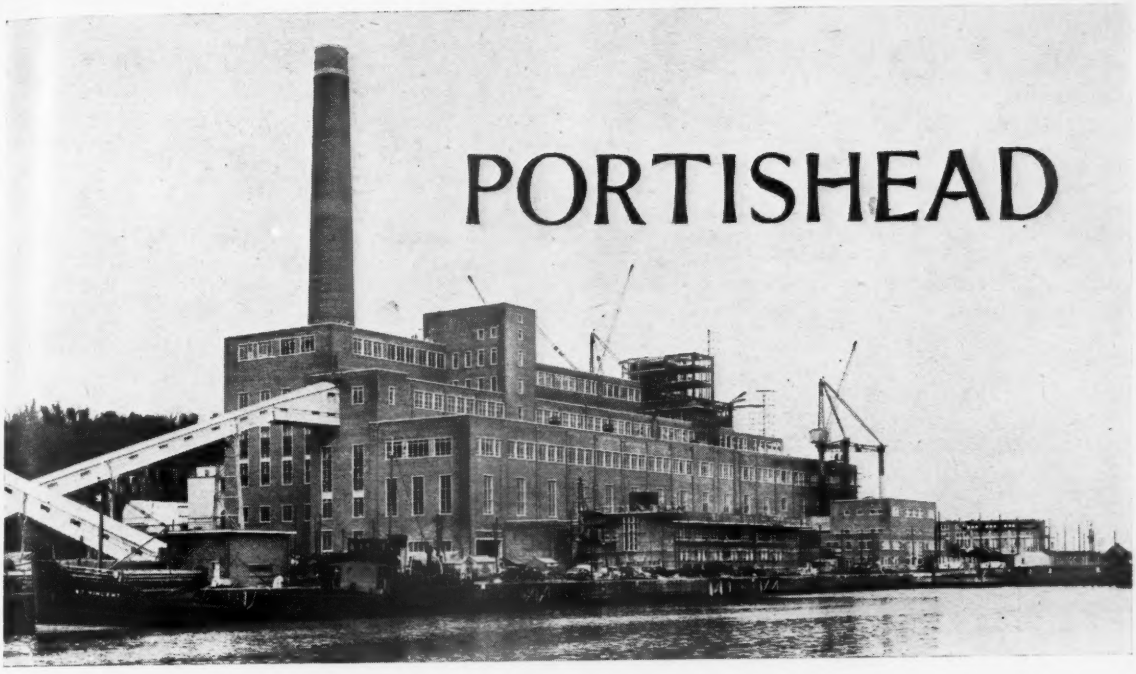
There was some feeling in favour of a move to Olympia but a show of hands indicated that support for this suggestion was quite small. Similarly the previously-taken ballot was overwhelmingly in favour of the continuance of the five-day exhibition and against extension of the time. Doubts were expressed whether the exhibition was attracting a very large number of overseas visitors but the organisers are to continue their endeavours to stimulate interest among possible buyers in other countries.

THE GOTLAND D.C. LINK

A booklet just published by the Swedish State Power Board describes the Gotland h.v. d.c. transmission link, the subject of an excellent lecture to the Institution of Electrical Engineers last year by Mr. A. Rusck, president of the Board. Some details are given of the operational experience to date. It was originally expected that perhaps several arc-backs would occur daily in the ionic valves which play so important a part in the d.c. system. However, valve design has been so much nearer to perfection than was hoped that in practice arc-backs have occurred not more than ten times a year. Also ageing of the valves due to loosening of the anode material has been slower than expected and it is calculated that they will not need to be opened for cleaning more than about once in five years.

Corrosion of the cable under the sea has been prevented by maintaining the conductor at a negative potential and tests at various times under various load conditions have shown that a negative potential of at least 1 V is being maintained on the sheath.

Sweden, which anticipates stepping up the operating voltage of its 380 kV system to 400 or 450 kV in some years' time, has to consider the alternatives for long-term planning of 400 kV d.c. or 650 kV a.c., and there can be no doubt of the value of the experience gained from the Gotland d.c. link not only for future developments in Sweden but throughout the world.



SECOND 60 MW SET COMMISSIONED IN 360 MW STATION

CONSTRUCTION of Portishead "B" generating station was first authorised in May, 1949, and work is now well advanced, the second 60 MW turbo-alternator set having just been commissioned. The station, which is due for completion in 1959, is being built on the Severn Estuary between the existing Portishead "A" generating station and the Portishead Dock at the northernmost tip of Somerset. It is planned to have an ultimate capacity of 360 MW comprising twelve 300,000 lb/hr boilers, eight arranged for coal/oil firing and four for oil firing only, and six 60 MW turbo-alternators, the steam conditions at the turbine stop-valve being 900 lb/sq in and 900 deg F.

The site, which is laid out as shown in Fig. 1, is very long and narrow and comprises about 28 acres only between the "A" station and the north-west side of Portishead Dock. Originally, the site was in full use by the Port of Bristol Authority and the British Transport Commission, and before full access could be obtained the existing Portishead railway station and marshalling yards had to be re-sited about half a mile to the south. Transit sheds and a flour mill had to be demolished and three 132 kV overhead circuits and several 33 kV underground cables had to be diverted. Preliminary site work was commenced in May, 1951, as soon as the consent of the Minister of Fuel and Power had been obtained, and full access to the final portion of the site was not obtained until January, 1955.

Because the site is so narrow the main station building, which runs roughly north-east to south-west, is 700ft long by 190ft wide and 135ft high. It is brick clad

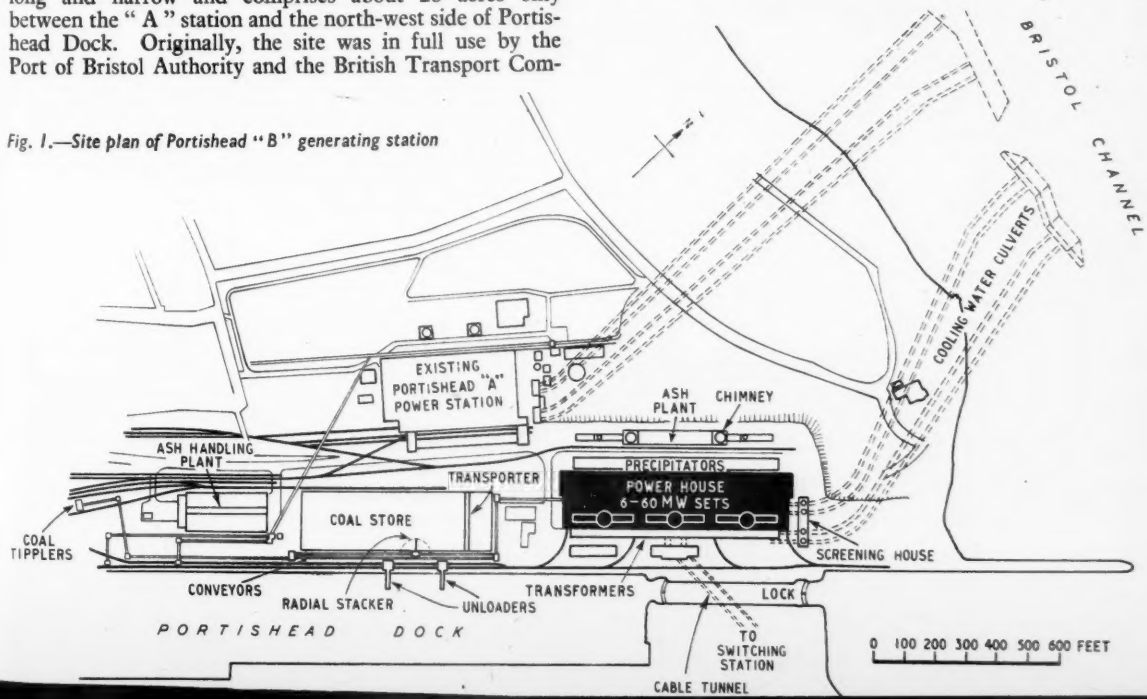
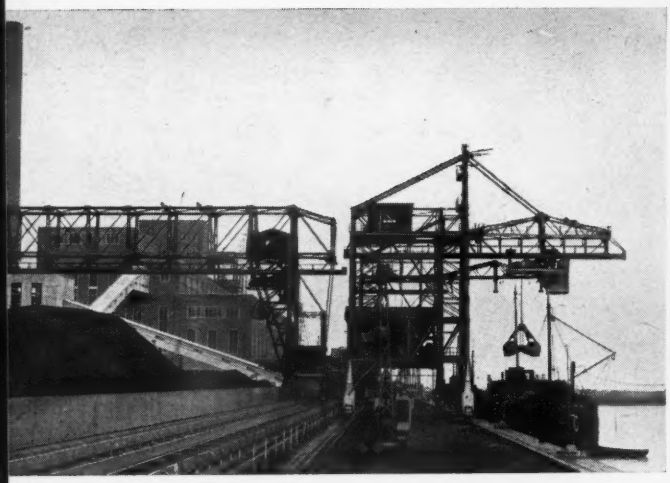
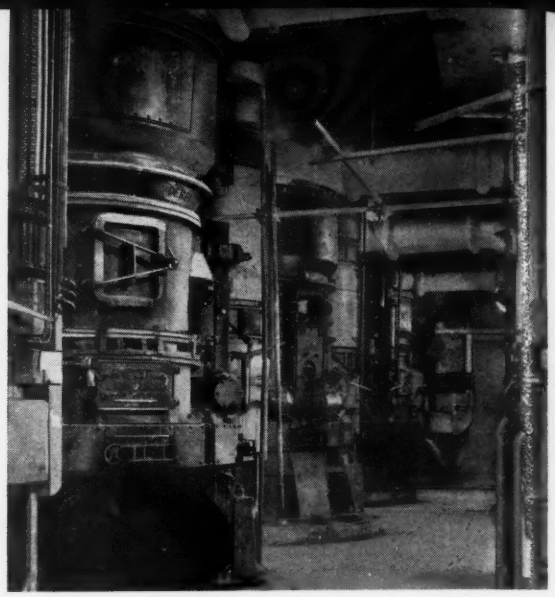


Fig. 1.—Site plan of Portishead "B" generating station



General view of the coal handling plant from the dock side



Three Lopulco type LM13 p.f. mills serve each boiler

in the conventional manner with a box column and plate girder structural steel frame. To the north-west side of the main building there are two 380ft high brick chimneys. The operations block containing the control room and office accommodation is to the south-east of the main building adjacent to the welfare block. The coal store is in line with and to the south-west of the main building and beyond this are the two ash settling pits.

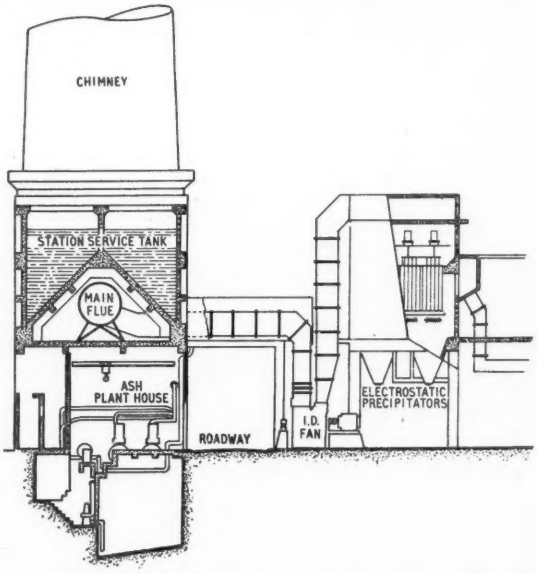
South Wales coal supplies are generally seaborne to Portishead Dock in colliers of 500 to 700 tons capacity. Alternatively, railborne coal can be off-loaded by wagon tipplers and fed to the conveyor system. The working coal store, which is situated on the south side of the station, has a capacity of 36,000 tons at a depth of 15ft. The emergency coal store, some distance away from the station, has a capacity of 105,000 tons. The bunker associated with each boiler has a capacity of 450 tons, making a total bunkerage for the completed station of 5,400 tons.

Coal Handling Plant

On the quayside are two telpher type unloaders which grab the coal from the boats and discharge it via a weigh-hopper recorder on to No. 1 belt, from which it can be delivered to either the station bunkers, the working coal store, or divided in any desired proportion to either. Facilities are also provided on the unloaders to deliver the coal direct into lorries for transit to the remote emergency coal store. A travelling telpher type transporter of 260 tons/hr capacity spans the working coal store and distributes the coal into stock, and also reclaims it as necessary back on to No. 1 conveyor. The coaling system is designed for 400 tons/hr capacity and incorporates weighing equipment so that by direct weighing, or by "differences," the distribution of the incoming coal can be recorded. At two points on the system magnetic separators (Magnetic Equipment Co., Ltd.) are installed to extract any tramp iron from the coal.

From the bunkers coal passes down through continuous automatic weighing equipment to "Lopulco" type LM13 10 tons/hr capacity pulverised fuel mills, there being three of these for each boiler. Not all bunker outlets have a weigher. Weighers are installed on one boiler only, and the others have chutes, arranged so that weighers can be moved to any boiler for test purposes. Each mill feeds one burner in each corner of the boiler combustion chamber and when two mills are running this is sufficient to maintain maximum continuous output. The motors driving the mill exhausters and coal feeders are of the variable speed type, speed control being effected by means of induction regulators.

For lighting-up purposes two oil burners are provided in the boiler front wall near the corner p.f. burners. They comprise burner bodies, caps, nozzles, etc., and are trunnion mounted and, by means of compressed air cylinders, they can be projected into or withdrawn from the combustion chamber. The fuel oil handling equipment comprises a complete plant for off-loading, bulk storage, heating, pumping and distribution. Ultimately, four 63·5 ton capacity storage tanks will be constructed on the site,



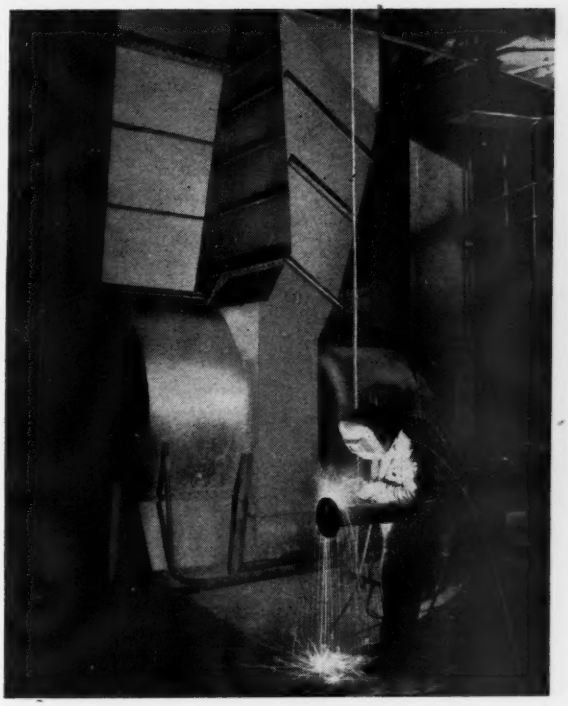
each being equipped with an 8 kW immersion heater to maintain the oil at an average temperature of not less than 45 deg F. High-pressure pumping and heating units are installed to feed oil to the burners.

Underneath each boiler a wet ash hopper is installed and from this the ash is sluiced by means of high-pressure water jets to a central swirlpit from whence it is pumped to the settling pits at the remote end of the site. Here, the water is drained off and pumped back for re-use in

the sluice system. Dust from the grit collectors, economisers, and the precipitators is also sluiced to the common swirlpit and then pumped with the ash. The drained ash and dust from the settling pits is taken away by lorry to the nearby ash disposal grounds.

The twelve 300,000 lb/hr pulverised fuel fired boilers are being manufactured by Mitchell Engineering, Ltd., the steam conditions at the superheater outlet being 950 lb/sq in and 925 deg F, with an economiser feed temperature of 385 deg F. The boilers are of two-drum design with radiant combustion chambers and the walls are completely water cooled by means of close pitched tubes. Each unit is suspended within its own steel framework which is supported from the main building structure, and is so arranged that all expansion takes place vertically downwards.

Each steam raising unit is equipped with Kent superheat/control equipment, the primary and secondary multiple loop elements of the superheater itself being of the self-draining type arranged in high and low temperature sections in the path of the gases. The superheaters are provided with permanent thermo-couples and instruments to record the metal temperature of the elements. Two de-superheaters with automatic temperature equipment and the necessary drains and sampling points are provided for each boiler. The economisers are designed on the contra-flow system, flue gases flowing downwards and feed water upwards. Provision is made for gases to by-pass the economiser when the units are starting up or on light load.



One of the f.d. fans in the boiler house basement

Two air preheaters of the Howden-Ljungstrom rotary regenerative type are provided for each boiler. Each preheater is designed to handle half the total air requirements and raise the air temperature from 80 deg F to that required by the pulverising mills and burners. Flue gas by-passes are not installed but facilities are provided to control the element temperature at low load. In the steam

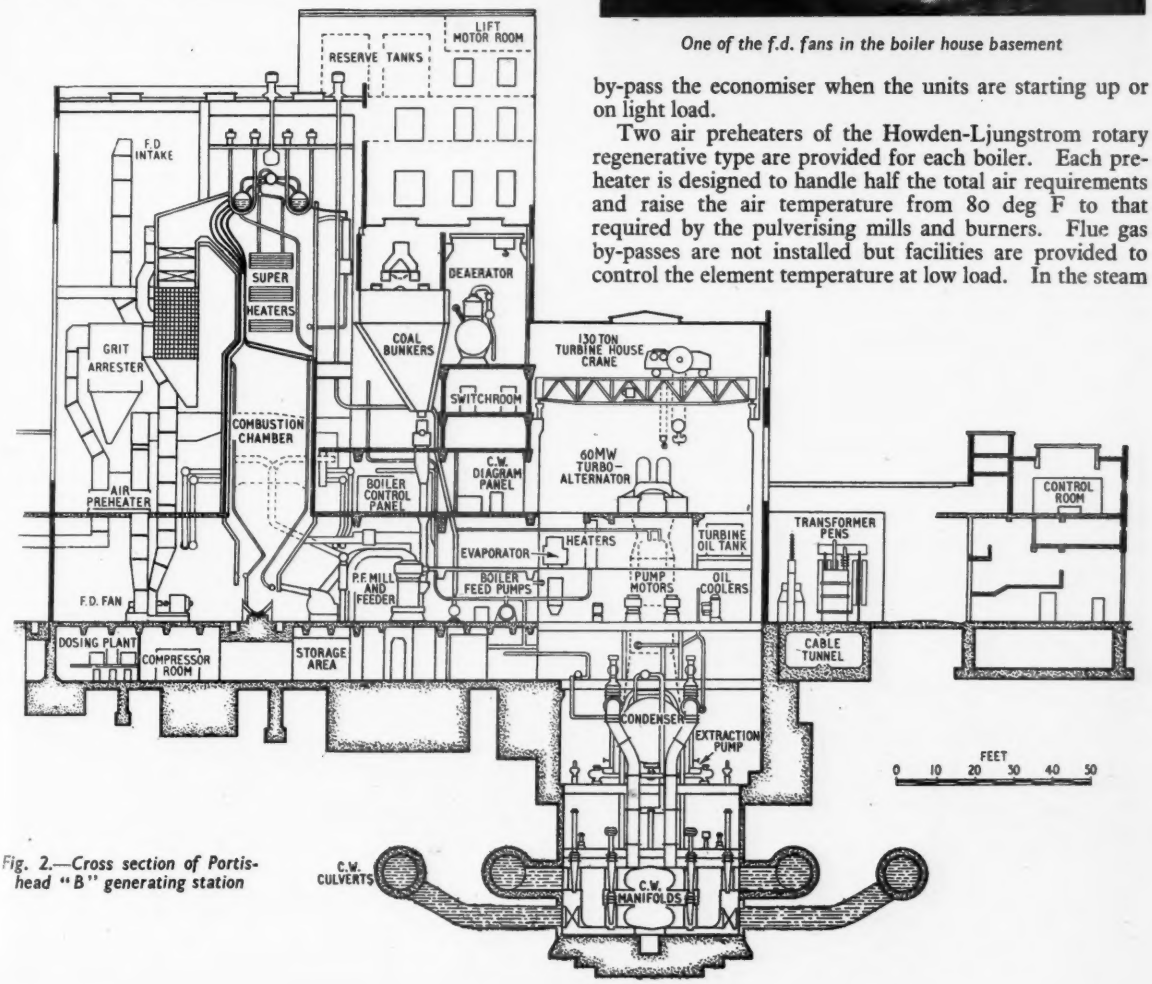
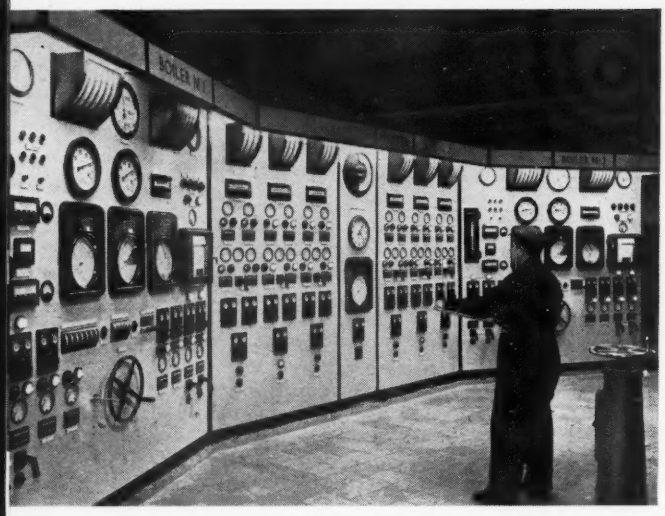


Fig. 2.—Cross section of Portishead "B" generating station



Combined control panel for the two boilers serving No. 1 turbo-alternator set

receiver for each boiler steam purifying equipment is fitted which is so designed that, in conjunction with the necessary drum baffles, the solid impurity at any point of discharge is limited to the equivalent of 0·5 reciprocal megohm per centimetre cube at 20 deg C on the condensed steam when the conductivity of the boiler water as measured at the front steam drum is 1,000 units.

A complete system of electrically operated fully sequenced soot blowing equipment is installed, the steam supply being drawn from the superheater headers. The blowers are arranged to operate in the direction of gas flow and are so mounted that they can be removed for examination and repair while the boiler is on load. Cooling air for the blowers is provided by an air scoop situated in the delivery side of each of the f.d. fans.

The draught plant comprises two Howden f.d. and two i.d. fans situated at basement level, and twin air preheaters used in conjunction with " Pratt-Daniel " mechanical grit arrestors, Valmont " S " type, and Sturtevant electrostatic precipitators. The plant is arranged so that each boiler will operate satisfactorily with one i.d. fan, one mechanical grit arrestor, one air preheater and one f.d. fan, in service at a continuous boiler output of at least 60 per cent of m.c.r. Both the f.d. and i.d. fans are driven by induction regulator controlled variable-speed a.c. motors.

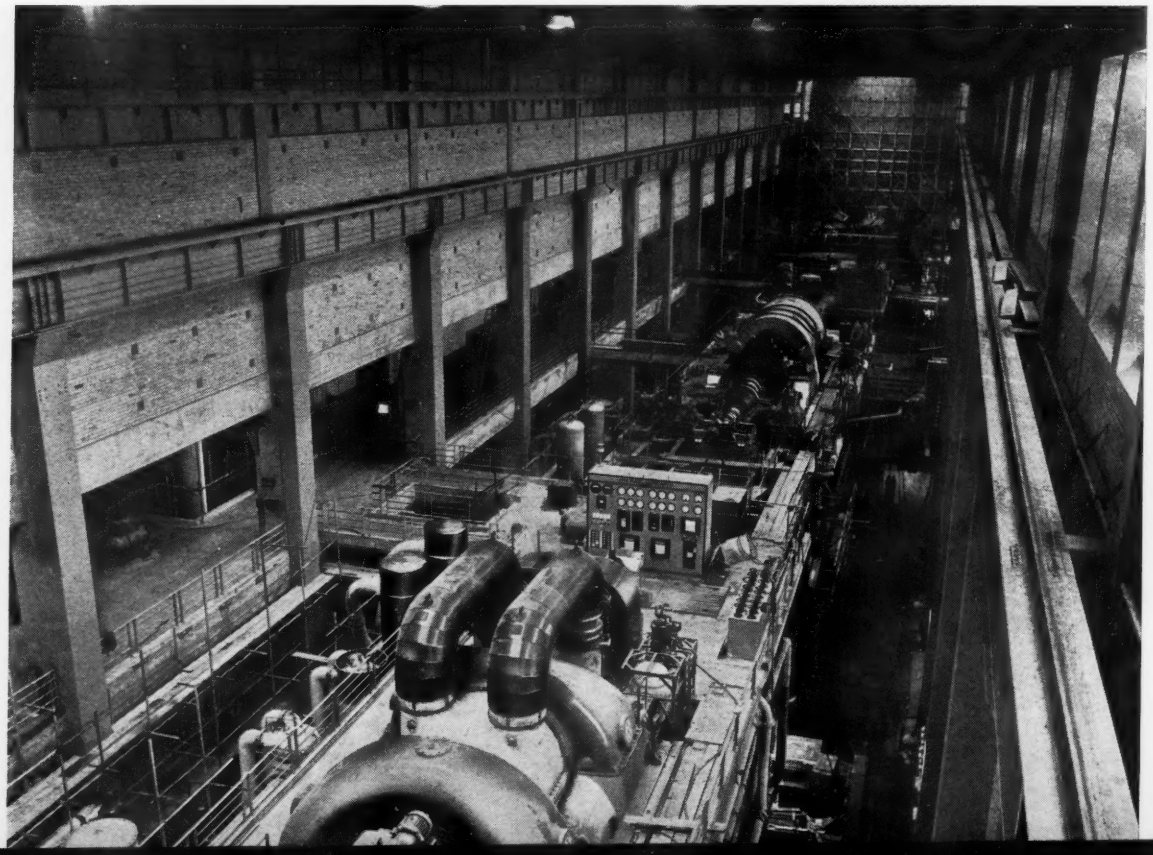
Each pair of boilers is operated together with the associated turbine from a combined semicircular panel situated at operating floor level between the boilers and turbine. For convenience of operation adjacent unit panels are arranged to face each other and there will be six such arrangements in the completed station.

Automatic Boiler Control

The system of automatic control for each boiler, by Bailey Meters, Ltd., is based on the regulation of total combustion air quantity proportionally to the boiler load and co-ordinated adjustment of fuel feed to the mills irrespective of the calorific value of the fuel and of furnace draught, so that between m.c.r. and 60 per cent of m.c.r. the output of steam is controlled automatically. A master controller connected to and actuated by the pressure in the steam receiver transmits impulses to relays which in turn regulate the compressed air supply to power cylinders, which by suitable linkage regulate the motor speed control gear on fans and fuel feeders.

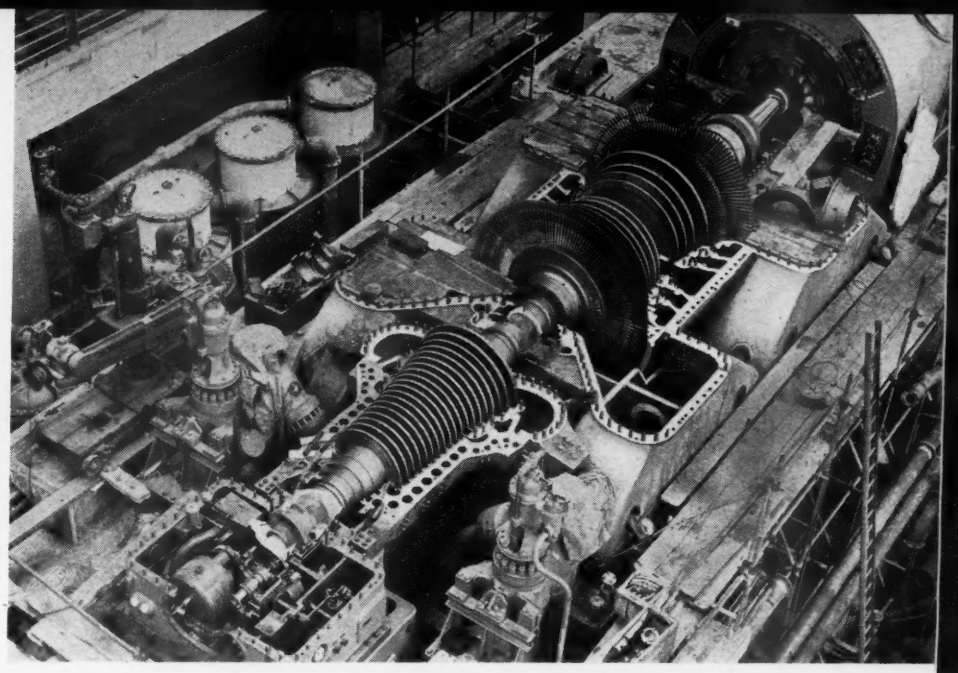
The system is arranged so that under normal operating conditions each boiler may be controlled automatically as an independent unit, subject only to a master pressure control common to each pair of boilers and to a control unit sensitive to the steam flow from each separate boiler. The arrangement incorporates automatic means of reducing

View of the first two-thirds of the turbine room indicating the unusual length of the station



the mill feeder output in the event of partial or total choking of the mill and reinstating normal fuel flow when such a blockage is cleared.

The six 3,000 r.p.m. hydrogen-cooled turbo-alternators are being supplied by the Metropolitan-Vickers Electrical Co., Ltd., each unit having a maximum continuous rating of 60 MW. The designed terminal steam conditions are 900 lb/sq in and 900 deg F at the turbine stop valve, with 28·9in vacuum and a final feed temperature of 385 deg F. The specified steam and heat consumptions when delivering 60 MW at 0·8 power factor lagging are 8·5155 lb/kWh and 9,299·3 B.Th.U./kWh respectively.



No. 2 turbo-alternator set during construction

The turbines are two-cylinder units arranged longitudinally down the turbine room with the steam ends of adjacent machines facing each other. These machines are the first of a new design to be made by Metropolitan-Vickers. The high and low pressure turbine rotors are rigidly coupled together and the cylinders are provided with annular steam belts at the various extraction points to enable steam to be drawn from the complete periphery instead of from localised areas to preserve thermal balance. Inter-stage drainage is provided where necessary to collect and lead condensed steam to a heater belt or to the exhaust chamber.

The main bearings are of the spherically seated type lined with anti-friction metal. Each bearing is provided with four pads under each of which a selection of liners is fitted to permit fine adjustments in any direction when aligning the rotors. The thrust block is of the Michell type and is combined with the h.p. inlet end journal bearing. As already mentioned the turbine rotors are rigidly connected by a bolted coupling, the position of the coupling being inside the l.p. cylinder adjacent to the gland. The rotors are mounted on a bearing at each end of the shaft with a third bearing interposed between the h.p. and l.p. cylinders.

Emergency stop and governor valves of the balanced pressure type are provided for each machine. The emergency valves are operated automatically by duplicate emergency overspeed governors on the main turbine shaft set to operate at 3,300 r.p.m. The emergency valves may also be tripped instantly by hand. Speed regulation is effected by a centrifugal governor operating the governor valves through an oil relay system. Hand and motor operated speed control gear enables the turbine speed to be raised or lowered by 5 per cent above or below normal while the machine is running.

Each machine is fitted with load pay off gear to reduce load automatically should the vacuum fall below 25in Hg. In the event of steam pressure to the turbine falling below 90 per cent of normal, pressure operated unloading gear reduces the steam demand of the turbine. This condition could arise through failure of ignition or other combustion trouble at the boilers. If pressure continues to fall the throttle steam flow is reduced to 10 per cent of the full load flow by the time the pressure has fallen to 85 per cent of normal. To provide the turbine operator with a guide to conditions regarding axial expansion, running clearances and the degree of eccentricity of the rotor a comprehensive system of supervisory control is installed on a panel adjacent to the h.p. cylinder of each machine.

There are two Metropolitan-Vickers three-stage air ejectors with surface inter-coolers and one quick-start air ejector for each turbine. The three-stage units are condensate cooled and each operates at a steam pressure of 500 lb/sq in and 1,400 lb/hr, while the quick-start ejector is supplied with steam from the auxiliary steam manifold at 900 lb/sq in, and discharges directly into the atmospheric pipe.

The two 100 per cent duty two-stage "Pervac" extraction pumps are driven by 140 h.p. 965 r.p.m. 3·3 kV a.c. motors and when working against a head of 285ft 9,100 lb/min of condensate is passed by each pump. The feed heating train consists of four surface heaters and one direct contact de-aerator heater, all of Metropolitan-Vickers manufacture. Condensate is pumped from the condenser at 81·8 deg F by either extraction pump and is fed through one air ejector, drain cooler and two l.p. heaters and gland heater, to the high level de-aerator heater. From here it passes through a feed pump to the two h.p. heaters and then to the boilers. The drains are cascaded back and passed through the drains cooler before entering the condenser. Make-up is introduced into the system through the reserve feed tank. A series of magnetically operated valves on the de-aerator heater enable water to be admitted to the system from the reserve feed tank, but if required water can be drawn from the system and passed into the reserve feed tank.

Associated with each pair of turbo-alternator sets and group of four boilers there are three 100 per cent duty electrically driven feed pumps and two 50 per cent duty steam turbine driven feed pumps. Each electrically driven pump is capable of delivering feed water at a rate of 650,000 lb/hr and 1,230 lb/sq in and serves two boilers, while the steam turbine driven pumps cut in automatically as a temporary standby at reduced feed delivery pressure. The centrally positioned electrically driven pump acts as standby for each pair of boilers and is started up by hand. All pumps are by Sulzer Bros., and the 3·3 kV driving motors by Mather & Platt.

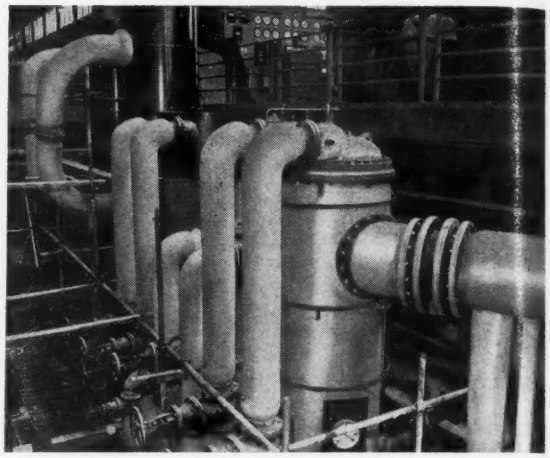
The water treatment plant comprises a single Permutit

precipitator with two pressure filters and base exchange softener to give 144,000 gal of treated water per 24 hours at 6,000 gal/hr average flow rate. The equipment includes automatic flow control and the 1 hr retention period in the precipitator enables variations in chemical treatment to be quickly detected.

Unusual C.W. System

The most unusual feature of Portishead "B" is the circulating water system. Four culverts are driven out to a dredged channel in the Severn Estuary and these are connected to three 45ft diameter 79ft deep pump pits which are arranged one between each pair of turbo-alternators. The culverts, which are concrete lined, are each about 600 yd long. The extremely high tide range at Portishead (over 51ft between the highest and lowest recorded tides) necessitates the culvert inverts being at −37·5 o.d. level to ensure that air is not drawn into the culverts and that the pump suctions are drowned at all stages of the tides. Each culvert (capable of passing 9,200,000 gal/hr, i.e. half station flow or full station flow in emergency) is intersected by a 21ft diameter 70ft deep screen shaft accommodating two Brackett 72in wide vertical band screens equipped with variable speed drives.

The circulating water conditions obtaining in the Severn Estuary necessitate reversal of flow characteristics, and the valve and pipework arrangement in the bottom of each pump pit permits the selection of any culvert for inlet or discharge. The valves are worked hydraulically to ensure rapid operation and also to reduce the amount of electrical equipment in the humid conditions prevailing in the pits. Each pump pit contains four centrifugal circulating water pumps of Drysdale manufacture, each with a capacity of 25,100 gal/min. The 460 h.p. 3·3 kV Metrovick pump motors are mounted at the turbine house basement level

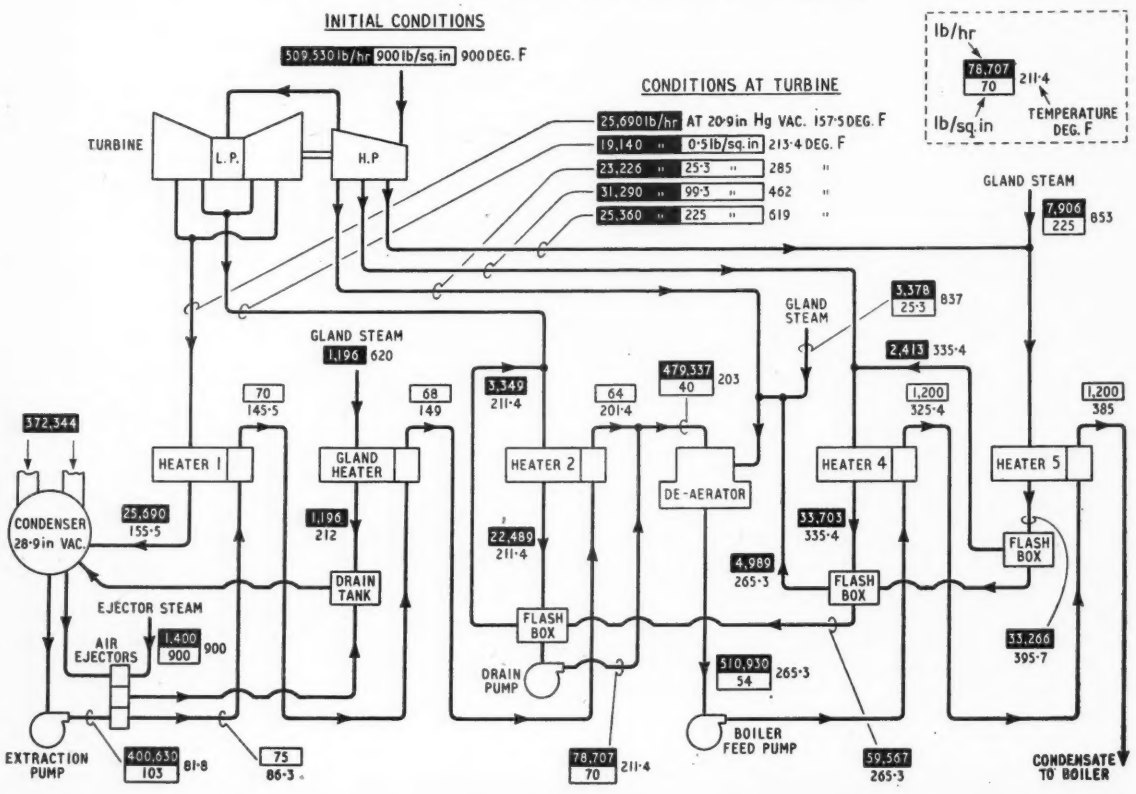


Feed heaters associated with No. 1 set

(30ft o.d.) which is about 75ft above the pumps and necessitates long vertical driving shafts.

Each turbine is served by a single horizontal condenser supplied by Metropolitan-Vickers. This has a cooling surface of 58,600 sq ft and is split vertically so that either half can be opened up for on load cleaning. Because of serious trouble with graphitic corrosion that has been experienced in this part of the country, a special protective treatment is being given to the cast iron pipes, crossover manifolds and condenser and cooler water boxes. The condenser water boxes are also electrically insulated from the tube plates and are being protected with a synthetic rubber coating. To take full advantage of syphonic action

Fig. 3.—Heat flow diagram for 60 MW set at maximum continuous rating



the condensers are situated low down in pits at −11ft o.d. level. The turbines stand at 58ft o.d. level and the exhausts are connected to the condensers by long steel trunkings. The total volume to be exhausted when raising vacuum is 17,770 cu ft and the equipment is designed for raising vacuum and running up to full speed in 41 min, using a steam exhauster and the two three-stage steam ejectors. The h.p. turbine glands are steam sealed and the l.p. glands water sealed at all speeds.

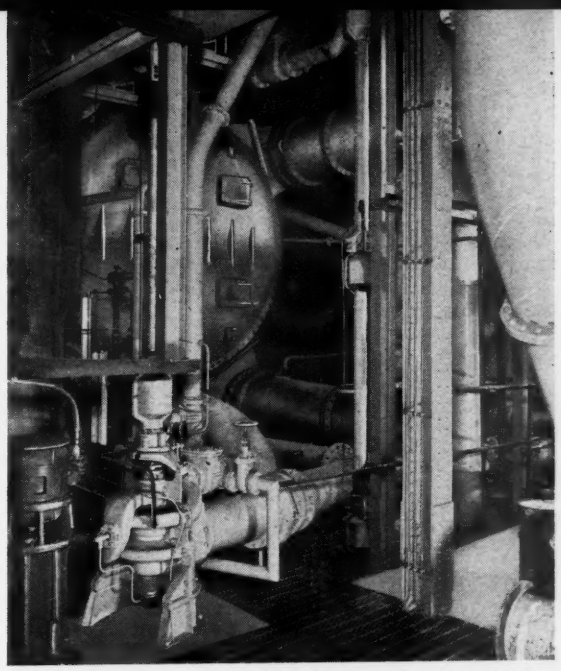
Each 60 MW 11·8 kV hydrogen-cooled alternator operates with hydrogen pressure at 0·5 lb/sq in, and the gas is cooled by circulating distilled water by means of four heat exchangers incorporated in the stator yoke. To prevent excessive leakage of hydrogen between the rotor shafts and stator frame, oil seals are fitted at each end of the stator casing; the oil seal supply is drawn from a compartment in the main oil tank by a pump of 25 gal/min capacity and delivered via an oil cooler to the seals. A small portion of this oil discharges to the outboard side of the bearing and returns to the main oil tank. The remainder discharges to the generator side of the bearings and so becomes saturated with hydrogen. This oil passes to a hydrogen de-training tank, thus completing the circuit. The system is provided with alarms to indicate undue rise or fall in the level of oil in the de-training tank and also with emergency supplies from the main oil services in the event of failure of the seal oil pumps.

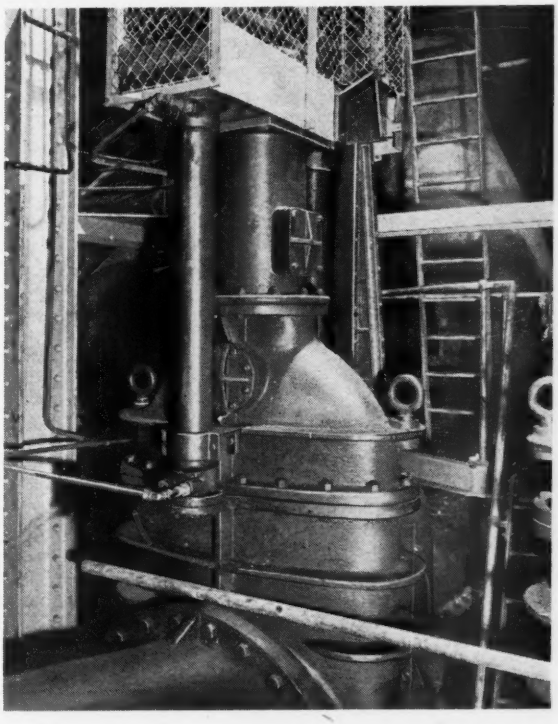
Electrical Connections

Each alternator is solidly coupled by four 1·25 sq in cables per phase to a 72 MVA generator transformer having a no-load voltage ratio of 11·8/141·6 kV with a voltage range via on-load tap changing equipment for a nominal secondary voltage of 132 kV with ±10 per cent over fourteen equal taps. Each transformer is of the ON/OFB type with natural cooling up to 50 per cent full load. The h.v. side is connected to the grid switching station about 900 yd away by 0·25 sq in three-core gas-filled cable. This route crosses the entrance lock to Portishead Dock and for the crossing the cables are taken down through two 8ft diameter cable tunnels under the lock 350ft long at a depth of 82ft below the ground. The existing "A" station 33 kV system is also connected through three 60 MVA transformers to this new 132 kV switching station.

Each set of four 11 kV cables per phase from the generator to its transformer terminates on a structure comprising four sealing ends strapped together and connecting to the transformer phase bushing by a tube type "fly-over." A fifth 11 kV sealing end is connected to the four grouped sealing ends through a removable link, facilities being provided for opening this link and connecting the "fly-over" to this fifth sealing end only, which in turn is connected to the 11 kV side of the 6 MVA unit transformer thus providing a source of starting supply for the generating station in the event of a complete shut-down of the "A" station from which starting supplies are normally obtained. The generator transformers and unit transformers are situated in outdoor cells along the south-east wall of the turbine room.

In the completed station the starting and common auxiliaries supplies will be obtained from three 7·5 MVA 33/3·3 kV delta-star connected transformers fed from the 33 kV main busbar system in the "A" station. These transformers are of the ON type with off-load ±2½ per cent and 5 per cent tap change. Each feeds a separate 3·3 kV station distribution board, emergency interconnection facilities being provided between the various boards throughout the station. In addition to controlling the larger common auxiliaries such as ash pumps, re-circulating pumps, standby boiler feed pumps, and coal and ash circuits, the three station boards provide supplies to each 3·3 kV unit board for starting purposes.





Above: The condensers are situated in pits and connected to the turbine exhausts by long steel trunkings. Below: One of the main hydraulically operated c.w. valves at the bottom of the pump pit

Normally, the supply to each unit board is provided by the 6 MVA 11/3·3 kV delta/star connected unit transformer, the 11 kV side of which is directly connected to the associated generator stator terminals. After starting up any machine/boiler combination and following the synchronising of the alternator, the unit transformer is paralleled for a short period with the unit board station transformer feeder before the latter is switched out. This leaves all the turbo-alternator and boiler auxiliaries running on the unit transformer.

Each 3·3 kV unit board controls the larger auxiliaries

of its associated boilers/turbo-alternator set, such as i.d. and f.d. fans, exhausters, c.w. pumps, extraction pumps, and boiler feed pump, together with one outgoing circuit to the 415 V unit board through a 1 MVA 3·3 kV/415 V delta/star connected unit transformer. The 415 V unit board controls, in turn, the supplies to the turbo-alternator auxiliary board, transformer auxiliary board, boiler auxiliary board, general services pumps, precipitators, and mill group boards, an emergency interconnection also being provided to this board from the 415 V station boards which take their supplies from the 3·3 kV station boards through 2·5 MVA 3·3 kV/415 V delta/star connected station auxiliary transformers. The 415 V station boards control supplies to the common station services such as ash plant, coal handling, station compressors, battery charging, lighting and heating, turbine house crane, and lifts.

The design and development involved in building this station has been carried out by the construction department of the South Western Division of the Central Electricity Authority with Sir William Halcrow & Partners as consulting engineers for the civil engineering works. The main contractors are:—Engineering works, foundations, tunnels, etc., Charles Brand & Son, Ltd; structural steelwork, Sir William Arrol & Co., Ltd.; superstructure and ancillary works, John Laing & Son, Ltd.; boilers, Mitchell Engineering, Ltd.; turbo-alternators and condensing plant, Metropolitan-Vickers Electrical Co., Ltd.; h.p. and l.p. pipework, Stewarts & Lloyds, Ltd.; coal handling plant, Strachan & Henshaw, Ltd., and Spencer (Melksham), Ltd.; ash and dust handling plant, John Thompson Industrial Constructions, Ltd.; 132 kV air blast switchgear, Metropolitan-Vickers Electrical Co., Ltd.; main and auxiliary cables, W. T. Glover & Co., Ltd., and British Insulated Callender's Cables, Ltd.; transformers, Metropolitan-Vickers, Bryce Electric Construction Co., Ltd., Yorkshire Electric Transformer Co., Ltd., and South Wales Switchgear, Ltd.; motors, Metropolitan-Vickers, Laurence Scott & Electromotors, Ltd., and Mather & Platt; station lighting, Geo. E. Taylor & Co. (London), Ltd.

Acknowledgment is due to Mr. A. C. Thirtle, Controller, South Western Division, C.E.A., for permission to publish this article, and to Mr. J. Irlam, generation engineer (construction) for the assistance which he gave us in the preparation of the material.

British Steel Melting Furnace in Canada

A STEEL mill recently opened in Edmonton, Alberta, by Premier Steel Mills, Ltd., is the only steel producer between Winnipeg and Vancouver, and is dependent solely on scrap to keep it going.

The plant has an area of 72,000 sq ft and cost $2 million to build. The three-phase direct arc melting furnace for the works was supplied by G.W.B. Furnaces, Ltd., of Dudley, Worcs, and is to the design of the British company's Italian associates, Leone Tagliaferri, of Milan. The mill is designed for continuous flow production, the steel scrap entering one end and emerging as finished steel bar at the other end. The maximum annual output at present is 35,000 tons.

4,700 kVA steel melting furnace being installed in Edmonton, Alberta

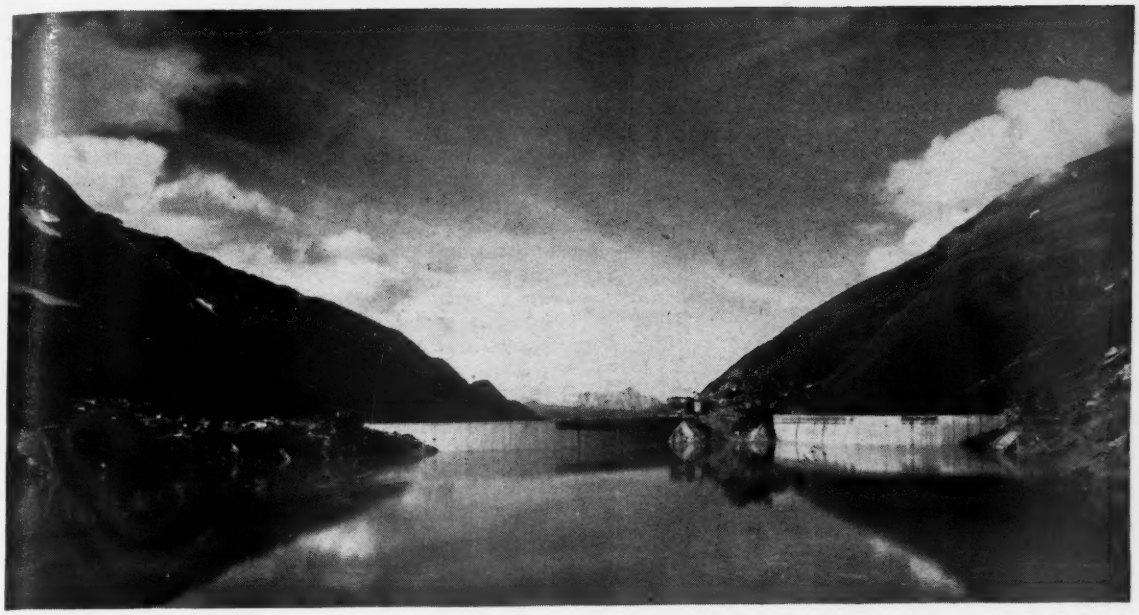
The furnace has a nominal capacity of 10 tons with an 11ft diameter shell, and is rated at 4,700 kVA, being fed with electricity at 13·6 kV, three-phase, 60 c/s. Following modern practice, the unit is of the top-charging type in which the roof is lifted and swung aside to receive the charge from the baskets brought into position by the shop crane. It is designed for an output of 96 tons per 24 hours and, in actual practice, the output varies between 90 and 145 tons per 24-hour working day.

The operation of the three 12in diameter graphite electrodes is controlled hydraulically by the Tagliaferri system. This is considered to be superior to the motor operated method since a finer degree of control and faster electrode operation are obtained, partly owing to the absence of inertia. It is pointed out that the electrode control system is part of a common hydraulic system for tilting the furnace body, lifting and swinging aside the roof and raising the door. A take-off from the hydraulic system permits unclamping of the electrodes to be carried out rapidly thus reducing to the minimum the time required for working on the hot roof. When in position the electrodes are held by spring-loaded clamps.

An expansion of the works is now being planned and a further electric steel melting furnace has been ordered from the same company.

Japanese Power Shortage

A CREDIT of $11 million has been granted by the Export-Import Bank of Washington to the Kansai Electric Company for thermal power development in Japan, where a severe power shortage now exists. This shortage is expected to continue for about five years. The country's power plants are mostly hydro-electric and geographical features have restricted the development of large reservoirs, with the result that there is a serious power shortage during the dry season from December to March. The new thermal power expansion programme is designed to supplement hydro-electric output. The Kansai Electric Company serves an area of approximately 12,000 square miles in south-central Honshu, including the important cities of Osaka and Kobe. This region contains about 14 per cent of the country's population.



WORLD POWER CONFERENCE

TECHNICAL sessions at the fifth World Power Conference, in Vienna, to which reference was made in the *Electrical Review* of 15th June, opened on Monday, 18th June, with a survey of developments of national power economics from 1950 to 1954. There was agreement among different countries that energy production had risen substantially, mainly in regard to electricity, petroleum and natural gas with a less sharp increase for coal. While electricity was responsible for only 1·7 per cent of the total gross production, its useful energy consumption was nearly 10 per cent of the whole. About 78 per cent of useful energy required in industry as a whole was used for heating and 22 per cent for mechanical power, efficiency of utilisation averaging 47 and 33 per cent compared with 100 per cent for electricity. Accurate comparisons were difficult owing to lack of consistency in terminology.

British energy resources in million tonnes were assessed by the Chief Scientist's Division, Ministry of Fuel and Power, as follows: coal, mineable in 100 years 21,950, proved reserves 130,900, additional probable reserves 43,000, underground gasification 500; methane from mines and from fermentation, 3·3 per annum; peat, 500 in Scotland alone; water power, 5 per annum; oil shale (Scotland only), 23; cannel 110; wind (all suitable sites used), 2 to 5 per annum; tidal (Severn), 1 per annum. Yearly imports of petroleum (million tonnes) had risen between 1938 and 1954 from 2·3 crude and 9·5 refined to 28·4 and 7, respectively, of which 25·2 had come from the Middle East. That region was stated by Mr. P. T. Cox (British Petroleum Co.) to have proved reserves amounting to three-fifths of those of the whole world and to be likely to produce double the volume of oil already discovered in it.

Since 1920 the contribution of petroleum to the world's energy production had increased from 12 to 50 per cent,

Title picture: The Moser and Drossen dams seen from the Tauernkraftwerke hydro-electric plant

Above: The Schwabeck hydro-electric plant

Below: The Weissensee reservoir of the Stubach division of the Austrian Federal Railways

during which time, Mr. O. F. Thompson (Shell Petroleum Co.) pointed out, the contribution of coal had fallen from 85 to under 50 per cent although its absolute consumption was greater as a result of an average annual increase of 2 per cent per annum in the use of all fuels. Concurrently, hydro-electric output had increased six-fold. By 1975, when nuclear energy might be supplying one-tenth of the energy needs of the United Kingdom (and no other country had yet announced any comparable programmes), the world demand for oil would probably be twice that in 1953.

By far the largest source of energy in Australia was coal, it was said on behalf of the Australian National Committee. Reserves were estimated at 15,250 million tons (average calorific value 11,500 B.Th.U/lb) and annual production was about 18 million tons. Brown coals (3,000 B.Th.U/lb) might amount to over 40,000 million tons, of which nearly 10 million was being mined each year. Water power development was restricted by low rainfall subject to heavy seasonal and annual variations. Installed capacity was 400 MW and was not expected to exceed 8,000 MW. The potential of the Snowy Mountains scheme exceeded 3,000 MW.

The increasing need for comprehensive and regular world statistics was stressed by Dr. G. H. Daniel (Ministry of Fuel and Power). These should cover demand and supply, reserves, and prices for each type of fuel and power. Present methods were inadequate and resulted in much overlapping of work between different agencies. It was suggested that the World Power Conference or the United Nations should convene a meeting of interested parties to consider appointing one central agency with responsibility for regular yearly publication of data. Other papers discussed the possibilities and limitations of more recent statistical methods with particular reference to the assessment of water-power resources and advance planning of fuel and power supply and demand.

Mr. G. H. Daniel

Trends in design of thermal power stations were governed by a steady increase in world-wide consumption of electricity at the rate of 6 to 7 per cent yearly and by growing shortage of fuel. The effect of these factors was illustrated by reference to the building of steam turbines of large output and high thermal efficiency. In the U.S.A. a total station capacity of 1,400 MW had been reached, with 200 MW as the greatest set capacity, but 340 MW sets were now under construction. All such installations operated on the unit principle.

Steam at 5,000 lb/hr and 1,200 deg F was now being raised in a 2,000 klb/hr monotube boiler. Up to 1,500 lb/sq in output boilers in the U.S. were predominantly vertical-tube natural circulation types; above that pressure forced circulation was necessary and flue gas temperature was reduced to 200 deg F to secure optimum boiler efficiency. Above critical pressure and 1,050 deg F austenitic steels were used. In Europe, where plant load factors were lower, there was less incentive to use fully all technical possibilities and the preference was for a maximum steam temperature of 985 deg F so as to permit employment of ferritic steels. The largest set was rated at 150 MW, but 200 MW sets were under construction.

In 1950 the highest station thermal efficiency anywhere was 33·5 per cent compared with almost 40 per cent now. This 19 per cent improvement was chiefly due to higher steam conditions, multiple reheat and extensive bled-steam pre-heating of feed water and owed but little to improvements in the already high efficiency of plant. The total gain due to reheat was from 2 to 4 per cent through the reduction of exhaust wetness below the maximum permissible of 14 per cent. Future improvements in thermal efficiency would primarily depend on the development of heat resisting steels to permit an increase of inlet temperature, or possibly by increased isothermal expansion within the turbine.

For large steam power stations 60 per cent of construction cost was incurred for boilers and mechanical equipment, 20 per cent for electrical apparatus and 20 per cent for buildings. Two 150 MW units would save about 10 per cent in construction costs compared with three 100 MW units. Outdoor construction in the southern regions of the U.S. saved 2·5 to 3 per cent in total plant costs, but increased maintenance costs of mechanical equipment. In Europe, in view of unfavourable weather conditions, outdoor construction was rarely adopted.

How present power station design in Great Britain was influenced by local circumstances was shown by Messrs. F. H. S. Brown and D. Clark (Central Electricity Authority). Shortage of plant immediately after the war called for the rapid installation of established types of generating sets of 30 and 60 MW. Not until about 1950 was it feasible to undertake more ambitious schemes. Since then the largest rating of 3,000 r.p.m. turbo-alternators ordered had advanced from 60 MW to 200 MW and steam conditions from 900 lb/sq in and 900 deg F to 2,350 lb/sq in and 1,050 deg F and 1,000 deg F reheat. The largest station so far planned (High Marnham) was of 1,000 MW in five units. The "unit" arrangement of one pulverised-coal-fired boiler with dry-bottom furnace to each turbine was the usual practice for new stations. Turbo-alternators were mostly tandem-compound with two or three cylinders up to 100 MW and with three cylinders above that rating. Supervisory equipment indicated and recorded mechanical and thermal behaviour of turbines, especially on starting and stopping. Steam-driven auxiliaries had been eliminated. Up to six stages of feed heating were used with surface-type heaters except for de-aerators. For high steam cycles feed pumping was in two stages, the feed heaters being subjected only to the intermediate pressure. All generators of 60 MW and over were cooled by hydrogen up to 30 lb/sq in; some had inner cooling of rotor coils and, for a 100 MW machine

Mr. F. H. S. Brown

The Burgtheater, Vienna

nearing completion, stator conductors also. Such means had permitted the design of 200 MW generators within a limiting transport weight of 150 tons. Recent buildings were predominantly steel-framed structures with lightweight cladding. Brick or concrete chimneys were up to 500ft high with gas efflux velocities of 70ft/sec. A single chimney would serve 500 MW of plant, thus gaining maximum benefit from the buoyancy of the hot gases.

The C.E.A. owned about 21,000 MW of plant operating at 40 per cent load factor. Provision was being made for bulk transmission of energy from large base-load stations on the East Midland coalfield to the south of England, but in the future the use of oil would make fuel supplies less localised and nuclear power stations would supply much of the base load. Operational flexibility would then become more important and much of the steam plant would be designed to run on a two-shift basis. On the average four new stations were being built each year.

Other matters discussed at the same session included gas turbines. Despite their virtual independence of cooling water resources and their high effective heat utilisation and quick starting characteristics, wider use had been prevented by the present limit of output to a maximum of about 30 MW. The largest yet built was a 27 MW open-cycle double-shaft machine in Beznau power station, Switzerland; the vanadium content of the heavy oil used necessitated keeping the temperature down to about 1,200 deg F. In combination with steam plants the gas turbine could increase the overall thermal efficiency and also the kW output obtainable per sq ft.

At a second session on thermal power plants the construction and operation of steam boilers were discussed. It was stated that since the fourth World Power Conference in London in 1950 attainable steam temperature had risen in nearly a straight line by roughly 18 deg F each year and had reached to-day a maximum of 1,200 deg F. The prevailing tendency in Europe favoured 1,000 deg F owing to the cost of austenitic superheater tubes at higher temperatures, which became worth while only above 1,100 deg.

Increased pressures, in principle, caused no difficulties in operation. These had risen since the introduction of unit operation and reheating and 1,150 to 2,850 lb/sq in were in use. Individual capacities had been raised to 2,400 klb/hr, but the general range varied between 450 and 900 klb/hr. Boiler thermal efficiencies of 90 per cent or more and an availability of nearly 100 per cent were no longer exceptional. This advance was largely due to improved (pressurised) furnaces and reduction in flue gas temperatures, accompanied by a deeper knowledge of causes and cures of fouling and corrosion and closer steam temperature control.

An illustration of research work in hand was provided by Dr. H. E. Crossley (C.E.A.) in an account of recent work of the Boiler Availability Committee. This covered investigations to correlate external fouling with chlorine content of the coals burnt and to explain the formation of sulphuric trioxide in flue gases and its reduction by carbon or its adsorption on smokes of carbon or zinc. The most important means of alleviating fouling or corrosion troubles were shown to be thorough cleaning of surfaces on and off load, recirculation of flue gas to the combustion chamber and improvement of methods of analysing deposits.

H. E. Crossley

P. D. Morris

Interior of the Vienna State Opera House

Technical problems of mechanical equipment provided themes for a third session on thermal power stations. In the design of condensing steam turbines the governing factors were given as inlet steam pressure and temperature, the latter depending solely on the properties of the materials used and increased ratings.

The gain in efficiency due to reheating was given as 5 per cent, which meant that overall savings in fuel consumption attributable to the 120 and 200 MW sets were respectively 16 and over 20 per cent. The effect of increased pressure and temperature on the maximum output obtainable from a given exhaust annulus area was shown to be 80 per cent for 2,350 lb/sq in compared with 600 lb/sq in. This information was given by Mr. P. D. Morris (British Thomson-Houston Co.) who exemplified recent progress with particulars of four tandem-compound machines being built by different British manufacturers, viz. 20 MW for nuclear energy plants (C. A. Parsons & Co.); 120 MW, reheat (British Thomson-Houston Co.); 120 MW, reheat (General Electric Co.); 200 MW, reheat (English Electric Co.). In addition, a proposal was described for the design of a supercritical element of a reheat turbine operating with steam conditions of 4,500 lb/sq in and 1,100/1,150 deg F (Metropolitan-Vickers).

The Parsons turbine received steam at 185 lb/sq in gauge (590 deg F) and, after the fifteenth stage, at 40 lb/sq in (340 deg F) to suit the characteristics of the reactor. Vacuum at the turbine exhaust was 1·75in and wetness of steam was 11 per cent. Regenerative feed heating was not employed. The B.T.H. machine was of single-shell construction, but that of the G.E.C. embodied a double shell for the h.p. cylinder having the outer casing pressure equal to that of the h.p. exhaust. The 200 MW English Electric turbine, due for commissioning in 1959, had double-shell construction for the initial eight stages

and single-shell design for four stages of the h.p. cylinder.

Whilst forged high-pressure casings were still common steel castings were more widely used for large turbines. Welding had increased considerably, particularly in the manufacture of exhaust casings. Steam temperatures from 900 to 1,050 deg F had necessitated the introduction of better creep-resisting low-alloy steels, e.g. molybdenum-vanadium or chromium-molybdenum-vanadium types, sometimes with the addition of tungsten. Some designs for 1,050 deg F had austenitic inner casings.

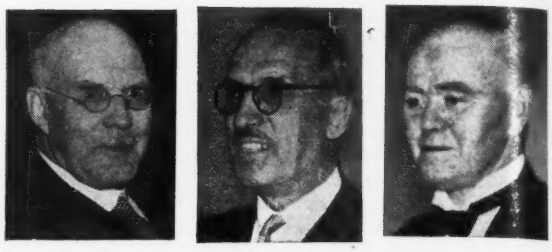
Rigid ("solid") couplings now connected main rotor shafts, which were regarded as essential in large three-cylinder machines. Improved materials and larger forgings had permitted higher blade speeds and greater blade lengths, with the result that machines of high ratings were comparatively short.

Recent developments in turbine governor and control gear largely concerned turbines operating on the reheat cycle. Protective devices included unloading gear, operated by failure of either exhaust vacuum or critical steam pressure, and supervisory gear. A trend towards remote control of machines was noted. Blading developments were chiefly in respect of high-temperature elements and of the last stage before the condenser. The most notable feature of turbine operation in Britain was the provision made for even the largest units to be started and shut down daily.

Hydro-electric plants were discussed under the two heads of theory and design and of construction and operation. Most of the 44 papers submitted by 22 countries on this subject were limited to special fields. It was reported that of recent years appreciable progress had been made in vibration tests of steel hydraulic structures, analysis of shell theory, static-model investigations for large dams, and cavitation tests and air-flow experiments for turbine structures.

Losses in head at high-pressure plants were shown to be reducible through new excavation methods and the use of Francis turbines instead of Pelton wheels. Maximum percentage efficiencies to-day reached 93 for Kaplan, 92 for Francis and 91 for Pelton types. Developments in power transmission had, by overcoming difficulties due to distances, been favourable to the further exploitation of water power sites. Reduced structure height and dimensions, fewer bearings and increase of specific speed were notable improvements since the last plenary World Power Conference in 1950. Each advance was associated with increases in the possible maximum heads for the three classes of turbine—Kaplan 226ft (France), Francis 1,476ft (Switzerland) and Pelton 5,740ft (Austria). Greatest horse powers were Kaplan 111,000 (McNary, U.S.A.), Francis 165,000 (Grand Coulee, U.S.A.) and Pelton 150,000 (Eimego in Italy, and Kemano in Canada). Improved properties of materials and electronic regulators also had an important influence. Outdoor construction of river plants was proving satisfactory even in raw climates.

View of the grounds of Schönbrunn palace



Sir Harold Hartley (president, W.P.C.), Sir Vincent de Ferranti (chairman, International Executive Committee) and Mr. C. H. Gray (secretary)

Generators were being totally enclosed and cooled by circulation and could be built for every size of turbine now available, reaching a capacity of 150 MVA (Stornorrfors). Overall efficiency of pumped storage and reversible pump-turbines had been considerably improved and had been put into service at higher heads; the largest was of 102,000 h.p. (Hiwassee, U.S.A.). Rated capacities in MW of power stations recently completed or under construction were: McNary (U.S.A.), 1 million; Kuibischev (U.S.S.R.) 2,100; Kemano (Canada), 1,800; Bersimis (Canada), 800. Three large schemes in India when completed would have an aggregate installed capacity of 1,100 MW.

Water-power utilisation was said to have reached the dimensions shown in the accompanying table, the fourth column of which (ratio z) shows potential water power on basis of minimum flow.

Continents	Utilised water power in million h.p.	Potential water power in million h.p.	Ratio-figure z
Europe... ...	48·5	64	1·3
North America	46·4	90	2·0
Asia	14·4	156	11·0
South America	3·9	62	16·0
Australia and Oceania ...	1·8	23	13·0
Africa	0·7	250	350·0
Total	115·7	645	5·5
(Without Africa)	(115·0)	(395)	(3·5)

The widening of the scope for pumped storage with the coming of nuclear power generation was generally recognised by those taking part in the discussions. About a million h.p. of pumped storage plant was in use on the Continent with heads varying from 33ft to 3,000ft, but only one of importance (Sron Mor, in Argyllshire) was as yet under construction in Great Britain, where conditions had been less favourable. In a paper on the practical

application and economics of pumped storage in this country, Messrs. A. A. Fulton (North of Scotland Hydro-Electric Board), T. G. N. Haldane (Merz & McLellan) and R. W. Mountain (Kennedy & Donkin) referred to investigations made by the C.E.A. into six schemes in North Wales and the Pennines. One at Ffestiniog (300 MW) had been selected for development and four others aggregating 750 MW were under consideration.

Ffestiniog would have four 75 MW sets and a total pump capacity of 2,400 to 2,700 cu ft/sec. Generated output would be 300 million kWh/annum. The gross head ranged from 981 to 1,059ft. A reservoir variation from 60 to 18ft would give a generating period up to four hours a day, with pumping for seven hours by night. Changeover from pumping to generation would be by mechanical couplings, taking 8 to 10 min per set. The scheme was estimated to cost £40/kW plus £7.5/kW for 275 kV transmission, compared with £60 to £65/kW for new steam plant.

In the North of Scotland three promising schemes were being considered, two superimposed on normal hydro-electric plants at Loch Sloy and Cruachan (Argyllshire). The other (Balmaha), containing 360 MW and estimated to cost £41/kW including transmission, would utilise an upper reservoir on Ben Lomond slopes and as a lower reservoir would have Loch Lomond; the gross range of head was 690 to 640ft.

Energy for pumping (at 12.5 per cent load factor) in Britain must come from thermal stations and not, as usual on the Continent, from waste water available from run-of-river or storage plants. It would not be provided by the fully loaded most efficient steam plant, but from older less occupied sets having an average incremental consumption of coal of 1.15 lb/kWh. Including transmission, it appeared that a pumped-storage plant costing £50/kW sent out would be cheaper than an equivalent thermal installation at £85/kW sent out (£70/kW installed).

Pumped storage was also dealt with by Mr. M. Braikevitch (English Electric Co.) in discussing some British developments in large hydro - electric plant. One example taken was the 280,000 h.p. installation at the two Sir Adam Beck power stations of the Ontario Hydro-Electric Power Commission. The proposal was to raise surplus water from the Niagara during the night into an artificial reservoir, from which it flowed during peak loads to drive the pumps as turbines, the water then going on to drive the turbines in No. 2 station. The head between reservoir and power canal was 55ft rising to 90 ft when the reservoir was filled. To get the pump head needed to suppress the gate apparatus a feathering Francis Deriaz runner was adopted.

Mr. T. G. N. Haldane

Mr. M. Braikevitch

Reversible pump turbines to operate under high heads (about 800ft) were also the subject of research at the expanded test house of the company with which the author is associated. These investigations were developments of the work done on high-head reaction turbines, such as four of the eight 175,000 h.p. 277 r.p.m. sets for the Bersimis project of the Quebec Hydro-Electric Commission (net head 875ft) and the four 134,500 h.p. 375 r.p.m. sets for the T.1 station of the Snowy Mountains Authority, Australia (net head 1,095ft).

The availability of Kaplan turbines for a head of 180ft enabled one machine of 28,000 h.p. at 250 r.p.m. with adjustable runners to be installed instead of two of the reaction type initially considered (in view of frequent running at less than half the full flow) for the Invergarry project of the North of Scotland Hydro-Electric Board with consequent financial saving. Only the runner, bearing assembly and shaft were not fabricated, in accordance with the practice now adopted for such schemes as the St. Lawrence development, for which 32 fixed-vane propeller turbines were being built with a total capacity of 2,400,000 h.p. at 75 to 87ft head.

Progress on the Snowy Mountains scheme was described in a paper submitted by the Hydro-Electric Authority concerned. The ultimate yield, as at present envisaged, was 5,830 million kWh from 3,000 MW installed in 15 stations entailing the construction of four main dams and over 50 miles of tunnels. This output was expected to be a relatively small proportion of the total energy required within a few years in New South Wales and Victoria, where chief reliance would have to be placed on thermal and, later, nuclear generation, so the load factor of the completed scheme would be only about 23 per cent.

SIR HAROLD HARTLEY'S ADDRESS

At the opening meeting on Sunday last, Sir Harold Hartley, the president, said that there had been placed in the hands of mankind a new source of power and vast new possibilities of a closer partnership with nature and of all that that implied. At the same time the world's needs and the world's desires were increasing even faster. The new developments had made the menace of war so great as to render it almost unthinkable. They had made possible new levels of productivity, higher standards of living, greater comfort, better health and more leisure. But they had shown mankind that the natural resources of the world were not unlimited and that they could no longer continue to squander them.

The discovery of the possibility of harnessing nuclear energy had come at a most timely moment and it would in time make ample supplies of energy available at places where the cost of transport of traditional fuels might be prohibitive. There was a widespread misconception that nuclear power had solved all our energy problems for good and all. Nothing could be more misleading; nuclear power was still in an early stage of experimental development and nobody could predict with certainty what form it might ultimately take. There were still many problems to be solved. The construction of a reactor called for new standards of accuracy and reliability of engineering. Much had still to be learnt about the behaviour of materials under prolonged and intensive irradiation. The papers to be discussed would throw much fresh light on all this. The demand for electricity was growing continuously and by 1975 perhaps as much as 50 per cent of the intake of energy might be distributed in that form.

With the heavy and long-term investment that was characteristic of the energy industries it was essential for each country to foresee what that pattern was likely to be. For that reason the periodic surveys of the energy economy of each member country that were presented at each of the Plenary Meetings were of special value. Equally the importance of forecasting energy demands and supplies threw an increasing emphasis on energy statistics. Here the World Power Conference could claim some foresight, as its Statistical Year Book had been a

pioneer effort in this field, made possible by the co-operation of all the National Committees.

The years since 1950 have been a time of rapid progress and they were specially grateful to their Austrian colleagues for their general reports, which provided invaluable summaries of the progress made in each of the fields to be discussed. This progress was reflected equally in the technical papers in each section.

There were many international specialist institutions dealing with these problems in their own particular sectors of the energy field. The founder of the World Power Conference, D. N. Dunlop, had the vision more than 30 years ago to foresee the need for a forum where the representatives of all those sectors could meet for the discussion of problems of common interest. It was a great tribute to Dunlop's imaginative conception that the original charter had remained practically unaltered.

Energy policies could not be based on domestic considerations alone. With the closely knit economic structure of the world and the erratic distribution of energy resources, they must take account of conditions in the world energy market and of the possibilities of increased international co-operation which they were to discuss in Vienna. Many of the newer member countries were in South America and South-East Asia, countries which were now experiencing the growing impact of industrialisation with the help of heat and power. With the ever closer ties between nations and the recognition of their community of interest these new members could count on the advice and experience of the older countries to assist them in their development.

Food was the most urgent need of the world to-day, and he would ask them to consider whether enough thought was being devoted to the place of power in agriculture as compared with the emphasis we placed on industry, and whether the confidence of the less developed countries in the benefits of industrialisation might not be deflecting too much of their effort away from agriculture.

Liability Under Electricity Regulations

Position of Sub-Contractors' Employees

By C. F. Mayson, A.M.I.E.E.

THE question of liability for breach of the Electricity (Factories Act) Regulations, 1908 and 1944, was raised in the Queen's Bench Divisional Court on 6th June and, as that Court's decision is of some importance to sub-contractors, it may be of interest to examine the position briefly.

The case considered was *Massey-Harris-Ferguson (Manufacturing), Ltd.* v. *Piper,* and was an appeal by the company from its conviction by the Lancaster Justices for breach of Regulation 1 of the Electricity Regulations. The company was charged as the occupier of a factory at Trafford Park, Manchester, with contravening the regulation in that a switch controlling the supply to an electrically operated overhead travelling crane was not so worked "as to prevent danger, so far as is reasonably practicable," and so caused injury to a Mr. George Lyth, a painter.

The painting of the wall and crane-work in one of the bays of the factory was being carried out by a firm of contractors, Mr. Lyth being one of their employees. The crane trolley wires were some twenty feet above the floor and Mr. Lyth, before going up the ladder to his work, inquired whether the power had been switched off. An employee of the company then operated a switch from "on" to "off" and told the painters that he had done so. Later Mr. Lyth came into contact with a live trolley wire and was killed. It transpired that the switch which the employee had operated had been taken out of use and no longer controlled the supply to the crane.

The company having been convicted by the Justices, it appealed on the ground that "danger" in Regulation 1 meant danger to persons employed by the occupier of the factory and that there was no evidence of such danger. The appeal was dismissed on the ground that the deceased was employed in the factory: whether he was employed by the occupiers was not the test.

The duty of complying with the Regulations is upon the occupier of the premises, which will constitute a "factory" if they come within the definition in Section 151 of the Factories Act, 1937, or one of the special categories dealt with by Sections 103 to 108 which include electrical stations, building operations and works of engineering construction. The "occupier" is the person running the factory, and this means that in the case of many building and construction jobs he is the main contractor to whom the site has been handed over by the owner.

The occupier's duty under the Regulations is, by virtue of Section 60 of the Factories Act, 1937, owed to "the persons employed" on the premises. It has been decided in cases dealing with other regulations that the term "persons employed" is not restricted to the employees of the occupier but includes all persons working on the premises, so long as they are lawfully employed there and are acting in the course of their employment. The *Massey-Harris-Ferguson* case makes it clear that, so far as the Electricity Regulations are concerned, the employees of sub-contractors are within that category.

PLASTIC INSULATED CABLES

TO bring together in a single publication the methods of test and testing requirements for various types of polyvinyl chloride insulation and sheathing of electric cables the British Standards Institution has just issued B.S. 2746:1956, "P.V.C. Insulation and Sheath of Electric Cables." Future cable standards and revisions of existing standards will thus be more easily kept up to date, since in certain clauses it will be sufficient merely to specify compliance with the appropriate requirements of this standard.

The recommendations of the Commonwealth Conference on Standards for Electric Cables, held in London in 1953, have been carefully considered during the drafting of the standard, but technical advances since the Conference and other considerations have in some cases precluded the adoption of the recommendations in full. It has been found that some of the tests included to ensure compliance with the requirements of the standard are conveniently made with the insulation or sheath in situ; for other tests, specimens removed from the cable are preferable.

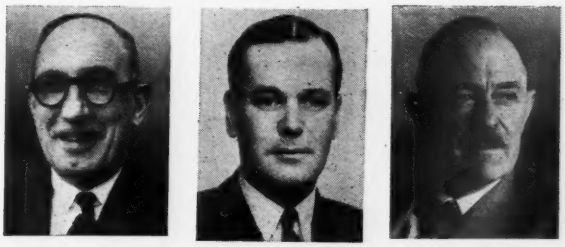
It is understood that the Ministry of Defence Specification DEF 9, used by Government Departments, will be withdrawn shortly. The Standard includes a colour chart giving thirteen standard colours. Copies of this 28-page publication are available from the British Standards Institution, 2, Park Street, London, W.1, price 7s 6d.

Mining Electrical Engineers' Conference

PAPERS AND EVENTS AT HARROGATE

THE first full-scale conference since 1954 of the Association of Mining Electrical and Mechanical Engineers was held at Harrogate last week when about 600 members and ladies attended. Added interest was lent to the occasion by the fact that last week was the town's French Week, an event which increases in popularity every year.

After a day of reunions and small parties on Tuesday as the members arrived in the town, there was an evening gathering at the Majestic Hotel with dancing. On the following day the annual general meeting of the Association took place in the morning, when Mr. J. D. Morton, B.Sc. (Eng.), delivered his presidential address.



Left to right: Mr. J. D. Morton (president), Mr. J. R. Cox and Mr. S. Winstanley.

Presidential Address

Choosing as his subject "Youth and the Mining Electrical and Mechanical Engineer," Mr. Morton first reviewed the earlier days of the coal industry when the policy "was to maintain a minimum strength of cheap labour and the aim of the entrant was to earn as much as possible as quickly as possible." He said that to waste deliberately inanimate materials in any industrial process was a misdemeanour of management that no organisation could condone or tolerate; but in the past industry, in general, wasted the growing man, on whom the prosperity of the nation ultimately depended, and many of to-day's management and production problems were closely related to what happened then.

The report of the 1905 Poor Law Commission stated: "The very serious fact emerges that between 70 per cent and 80 per cent of all boys leaving elementary school enter unskilled occupations." Was not that a shocking judgment upon a nation that led the industrial revolution, and more so when subsequent researches more than confirmed such a judgment? The president then outlined the post-war outlook, particularly in respect of the changes in the birth-rate and the number of youths available to industry on leaving school.

Dealing with training schemes, Mr. Morton said that at the turn of the century the practice of premium payment to employers persisted, but in the crafts of the mining industry this had long been absent. Aptitude was not the sole consideration when entering upon an apprenticeship; the economic factor was important. The usual period of apprenticeship was still five years; that period might have been suitable for a raw child from an elementary school, but surely it could not be appropriate for a boy of 15, or even 16, years of age, particularly if the full period of apprenticeship was covered by a suitable and systematic training.

It was on that premise that the A.M.E.M.E. Northumberland Sub-Branch submitted to Council in 1944 a motion "that at the age of 19 years, or at the end of three years' approved training, whichever the greater, a person shall be deemed to have completed an adequate period of engineering apprenticeship, and under any proposed Coal Mine Regulations be qualified, after satisfactory examination by a responsible authority, to hold a provisional certificate of competence for mining engineering maintenance, this certificate to become void at the age of 21½ years, unless at, or before, this age the person shall have confirmed by examination, or progress, that he is then a person fully competent to comply with all terms and references of the Coal Mines Acts, existing and proposed."

Colliery Cables

In the afternoon at the first technical session of the conference, a paper was presented on "Colliery Cables" by Messrs. J. R. Cox and S. Winstanley.

After a historical survey of the development of colliery cables, with particular reference to earthing problems, insulation and trailing cables, the authors dealt with modern advances in cable design. They said the "drained" type of cable was produced by the normal mass-impregnation process, but before being lead-sheathed the cable was drained of all surplus impregnating compound under vacuum. The "non-bleeding" cable was generally produced by drying and impregnating the paper insulation before application to the cable conductors; in this method of production no mass-impregnation subsequent to insulating was necessary, and as a consequence draining was not needed.

In recent years new forms of paper-impregnating compounds had been developed. These compounds, in addition to having high electric strength, possessed the virtue of not flowing at the highest temperature at which loaded cables were expected to operate. Compound migration was impossible, and such cables might truly be said to be "non-draining." If the cable was produced by the mass-impregnation process, draining before lead sheathing was unnecessary. Cables produced by the pre-impregnation method were inherently non-draining, and the process remained as it was in the earlier years.

Following an accident at Knockshinnoch Castle Colliery, Sir Andrew Bryan, then H.M. Chief Inspector of Mines, recommended that consideration should be given to the provision of a type of telephone cable for underground use in mines which would be highly resistant to damage from inrush, inundation or fire.

The Cable Makers' Association set out to produce a cable having at least the mechanical strength of the Knockshinnoch type, but with the added virtue of fire-resistance. Initially, 21 cables were produced, all of different constructions. Vulcanised rubber, polychloroprene and p.v.c. were used both for insulation and sheaths, and the whole range of cables was subjected to a series of mechanical and electrical tests, which were described in detail elsewhere. One of the cables was found capable of

maintaining satisfactory telephone communication after being subjected to a temperature of 600 deg C for four hours. Its construction was as follows:—

3/0.036 sq in conductor, glass braided, silicone varnished vulcanised rubber insulated. Two cores laid up, tough rubber sheathed, armoured with a single layer of galvanised steel wire, braided and compounded. When p.c.p. or p.v.c. were used in place of natural rubber the results of the fire-resistance test were not satisfactory.

The efficiency of the cable might be attributed to the following factors:—

(1) The glass braiding applied to the conductor was coated with a non-carbonisable, non-halogen-containing material such as silicone varnish. This coating provided a barrier which would prevent material from the main body of the insulation, which might become carbonised by internal heat, from penetrating the glass braid interstices and providing a semi-conducting path between the conductors.

(2) The core insulation and the sheath were of non-halogen-containing materials; halogen-bearing compounds could produce condensible vapours of ionisable material, such as hydrochloric acid, lowering the resistance between two wires of a pair in the cooler parts of the cable.

The cable proved satisfactory mechanically, but was unacceptable on economic grounds. Further work was undertaken and another range of cables was tested. Two gave encouraging results. The first of these was similar in construction to the original fire-resisting cable, but the v.r.i. insulation of the cores was not so thick, in order to decrease weight and cost. Whether it would prove acceptable was not yet known. In the second cable each conductor was insulated with a number of laps of silicone rubber-proofed glass tape. The insulated cores were laid up, tough rubber sheathed, armoured and finished in the normal way.

Economically, the use of aluminium conductors in insulated cables was not formerly attractive. They had to be larger than their copper equivalents, and greater quantities of insulating and protective coverings were needed, adding considerably to the cost. The high and widely fluctuating price of copper had changed the economic picture. The price per ton of aluminium was now very much less than that of copper, and its specific gravity was only about 30 per cent of the latter. Thus in many instances the lower cost of the aluminium conductors would more than offset the added cost of the insulating and protective coverings. At least one experimental length of aluminium shaft cable had been installed in coal mines.

Dealing with probable future developments, the authors said that the availability of many new materials was already influencing cable construction. The synthetic rubber p.c.p. was now used exclusively for colliery trailing cable sheaths; p.v.c. insulation had been introduced into telephone cables and power cables, and p.v.c. sheaths were being used as fire-resisting anti-corrosion coverings for armoured cables; polythene had been employed in telephone and power cables; and in the fire-resisting telephone cable, use was made of glass and silicone varnish.

It was not anticipated that the near future would bring revolutionary changes in trailing and drill cable designs. It was hoped that progress would continue to be made, but the negation of progress might result from the revoking of Article 131 (h) of the General Regulations, which specified that trailing cables should not be dragged along by the machine when working.

Discussion

In opening the discussion on this paper, Mr. P. N. Wyke (N.C.B.) said that with the increasing loads trailing cables

Winding a large fan cooled motor in Brook Motors' Works.

were getting so heavy that they could hardly be dragged along the face. He thought the real answer to this rested in the use of higher voltages. He thought manufacturers should carry out ageing tests on trailing cables before they were installed, and he had found conducting rubber trailing cables to be unstable.

Mr. E. Loynes (N.C.B., Manchester) asked whether aluminium-sheathed cable without steel armour would stand up to the requirements.

Mr. G. M. Harvey (N.C.B., Caterham), dealing with standardisation and agreeing that it should not be allowed to stifle development, suggested that the trailing cable was ready for some standardisation in certain basic aspects because things were becoming somewhat confusing. He suggested the development of screened drill cable and thought that aluminium offered no general advantage over copper.

In a communicated contribution Mr. E. W. Eaton (N.C.B.) spoke from personal knowledge of a 750-yard length of three-core 3.3 kV unearthed 0.12 sq in, aluminium-cored, aluminium-sheathed cable which had given satisfactory service for four years. He also thought that higher voltages would be necessary to overcome trailing cable difficulties. Mr. J. E. Radley (N.C.B., Sunderland) asked if there was any risk of p.v.c. cables slipping through the armouring.

Mr. B. L. Metcalf (chief engineer, N.C.B.) gave some impressions of a recent visit to Russia. The Russians were working on 380 V at the face and were now planning to use 660 V, but that seemed to him to be going only half way; he advocated 1,100 V. Some of the Russian facilities for research were in advance of ours. He had seen no silicone rubber but the Russians were using conducting rubber.

Mr. T. Storrs (N.C.B., Wolstanton) said that in his area there had been installed an aluminium shaft cable. He did not think there was any future for the screened drill cable because it was subjected to so much vibration. He

suggested joint boxes every, say, 50 yards along the main, so that the maximum length of any trailing cable could be limited to about 25 yards.

Mr. T. H. Williams (N.C.B., Bournemouth) thought that sensitive earth leakage protection in conjunction with conducting rubber was the safest device ever used for trailing cable in mines. He asked whether the authors would install conducting rubber cable if they had a colliery of their own.

Mr. G. Rutter (N.C.B., Cardiff) estimated that about 60 per cent of the accidents to trailing cables were due to shot firing and about 20 per cent to misuse. He asserted that a 150-yard length of trailing cable could be dragged along the faces providing there was no obstruction.

Mr. H. Watson-Jones (N.C.B., Newcastle) asked which of the two new fire-resisting colliery cables mentioned in the paper was the better.

Another speaker thought the authors should have given more attention to plastics insulated cables, in view of their growing importance.

Both authors replied to matters raised in the discussion. Among the points upon which they touched were the following:—

Trailing cables made up with shorter lays resulted in heavier cable, so that the cure could become worse than the disease. Generally speaking, aluminium cable without steel armouring could be satisfactory. Probably most of the troubles with drill cables in operation were of a mechanical nature. Some form of split conductor might be desirable in trailing cables.

No trouble had been experienced as the result of p.v.c. cable slipping through the armouring, and it was thought that any temperature likely to be reached would not cause cracking. The authors would certainly install conducting rubber cable if the controls were satisfactory. At the moment the plastics type of cable was the least in use and the future position was unknown.

A vote of thanks to the authors was proposed by Mr. W. Rochester (Glasgow).

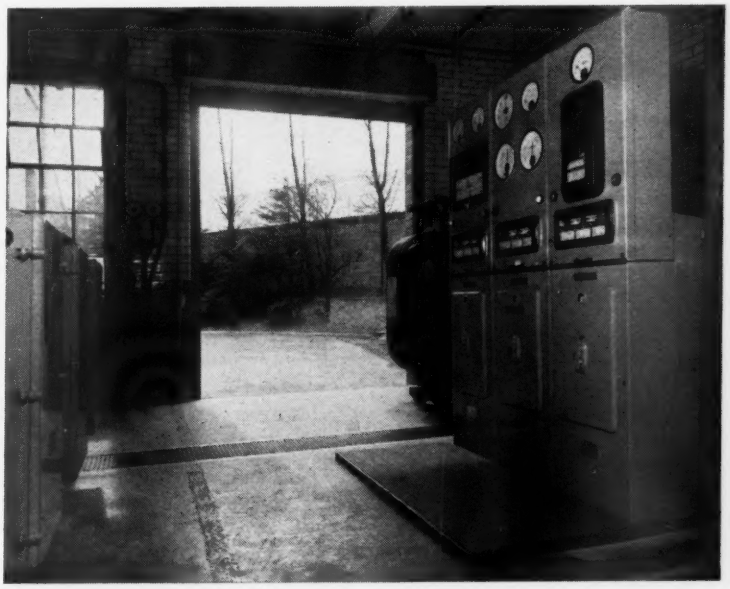
During the day the ladies took part in a tour which included a visit to Harewood House in the morning and a drive through some of the Dales in the afternoon. In the evening there was a civic reception at the Majestic Hotel by the Mayor of Harrogate, Councillor Robert J. Riley, J.P.

Visits to Works

Thursday was devoted almost entirely to works visits. Alternative visits for the men included a tour of the Brook Motors works, Huddersfield, when they saw all the production sections for the range of industrial motors from 1 to 25 h.p., the larger motors from 25 up to 600 h.p., and the "Gryphon" range of f.h.p. motors, each of which are separate self-contained sections. Processes are, of course, similar in each case, i.e., machining of components, pressing of stampings and rotor production. The visitors also saw the research laboratories and the jig and gauge and load testing and inspection departments.

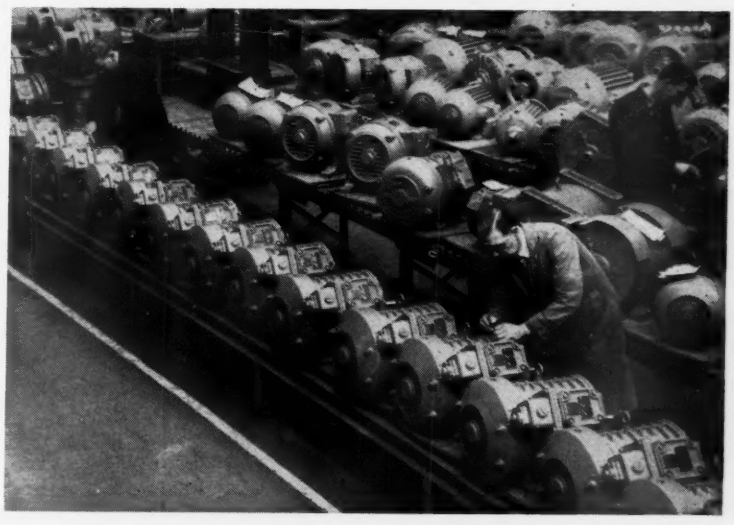
At the same company's Barnsley Works, the winding department, with its electronically controlled work handling system, was seen, along with the new testing equipment for stators. In the section dealing with the production of control gear a pneumatically operated plough system feeds work automatically from the storage conveyor to the assemblers on the starter production lines. Multiple control panels for large machine or complete factory control were seen in process of assembly. A production line has just been set up for the new domestic appliance motor, the "Merlin."

In the works of the Yorkshire Switchgear & Engineering Co., Ltd., visitors saw the production of type IVI metal-clad switchgear in the following ratings: 150 MVA, 3.3 kV, 6.6 kV and 11 kV; 250 MVA, 6.6 kV and 11 kV; 350 MVA, 11 kV; and 250 and 500 MVA, 22 kV.



Indoor sub-station with three-panel Yorkshire Switchgear equipment.

Flameproof motors ready for dispatch from the English Electric Bradford Works.



This switchgear is of unit construction, providing a high degree of flexibility and interchangeability.

A factory extension programme is in progress at the works, but this is not expected to reach its final stages for some two or three years.

The Thornbury, Bradford, Works of the English Electric Co., Ltd., now has a floor area of about half a million square feet and near it is a modern, well-equipped iron foundry, one of the largest in the country. The works is now primarily concerned with the manufacture of rotating electrical plant, ranging from 1/50 to 2,000 h.p., and is split into three main sections, aircraft electrical equipment, f.h.p. motors, and industrial motors.

An extensive range of a.c. and d.c. motors, alternators, d.c. generators and control gear is manufactured in a variety of enclosures. The industrial range includes Buxton certified flameproof machines for use underground, a.c. slipring motors for winder duty and B.S. dimensioned motors, of which considerable numbers have been supplied for use in coal washeries.

The main works at Horbury of Richard Sutcliffe, Ltd., which were also visited, at present demand about 500 kVA, though this is likely shortly to be increased to 1,000 kVA on account of works extensions. The system is operating at a power factor of 0.95, 65 kVAr of motor capacitors being employed, together with four 50 kVAr auto line capacitors controlled by a four-stage cubicle; this equipment was supplied by British Insulated Callender's Cables, Ltd.

The following are some of the more interesting drives at Horbury. The central compressor is driven by a 45 h.p. slipring motor and the plating shop compressor by a 62 h.p. slipring motor. The drive of the Darling & Sellers planer (used for machining driving head baseplates) is 30 h.p., and there are several 20 h.p. drives.

An interesting application of power at the Healey works of the same company is in the 25 kW induction heater and its associated handling equipment, which are used for hardening pins and bushes for plate conveyors and for the heating of links before bending. This unit operates at a frequency of 450 kc/s and has a loading of 56 kW.

Delegates visiting the Stennard Works of British Jeffrey-Diamond, Ltd., Wakefield, saw the flow of work from the foundry, through the workshop, and on to final assembly, and inspected a comprehensive range of the company's products.

For testing the electric motors produced, a variable voltage from zero to 760 V is provided by a 225 kVA, three-phase transformer with its secondary winding wound for 810 V, centre tapped at 425 V, in conjunction with a moving coil regulator. The motors are produced entirely for use underground and are therefore fully flameproof. Included in the factory installations are four 21 kW hardening and tempering furnaces and five 90 kW multiple, six-operator welding units: the majority of the machines in the works are individually driven.

In the winding shop the visitors saw motors ranging from 5 h.p. to 75 h.p. in various stages of completion. These, according to size and application, are single or double squirrel cage types with Class A or B insulation.

Alternative visits for the ladies on the same day included the Dewsbury Mills of Wormalds and Walker, Ltd., which have been developed to their present stage since 1933 when a 1,500 b.h.p. pass-out steam turbine was installed to serve a 625 kW alternator and a 650 h.p. mechanical rope pulley drive. Now there is a total electricity supply of 2,400 kVA at 415 V and 240 V. The existing mechanical drives are gradually being abolished, and schemes are in course of preparation for the complete electrification of both Dewsbury and Ratcliffe Mills, and the whole of the electricity is to be supplied by the Yorkshire Electricity Board. Automatic power factor correction is installed at the Dewsbury Mills.

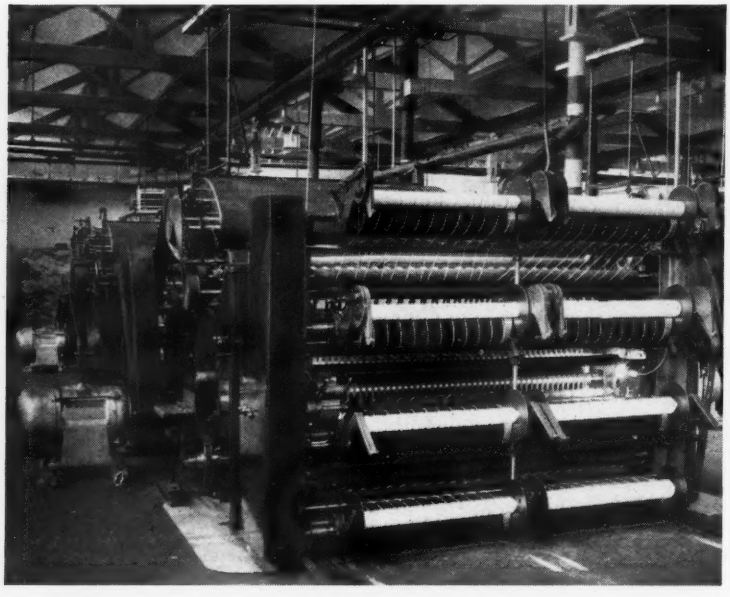
In the Albert Mills, Dewsbury, of James France & Co., Ltd., the majority of motors used are small and transmit via "Miraclo" flat belts to the individual machines. This belting has greatly simplified the conversion from steam line-shaft drives to individual electrical drives.

The annual golf tournament for the Heyes Trophy was also a feature of Thursday's programme, and in the evening there was a general visit to the Music Hall Francaise.

Thornton Lecture

The following morning's session was devoted to the annual Thornton Lecture on "Psychology of Accidents" by Mr. J. W. Whitfield, who said that in the first decade of this century it was reasonable to wonder whether reaction time and personal liability to accident were related. Now that it was believed that personal qualities were susceptible to simple direct measurement, it seemed desirable to establish a procedure whereby "bad accident risks"—in insurance terms—might be identified, and restrained from entering hazardous occupations.

In practice the distribution of accidents departed from chance expectation: there were even more people than would be expected with no accidents, and even more than would be expected with very many. Statistical analysis of the 1917 munition workers' data showed that this departure was not a sampling error but demonstrated individual differences in accident-proneness.



Scribbler and carding machines with 10 h.p. individual drives at the Dewsbury Mills of Wormalds & Walker. (By courtesy of Brook Motors, Ltd.)

A child's intelligence test performance was related to its subsequent examination performance, or to the teacher's estimates of its ability. The accident situation was a much more permanent and ruthless examiner. No credit was given for skilful avoidance of hazard, no allowance for fatigue or physical malaise, but penalties were inflicted whenever there was failure.

If a dangerous event occurred without warning, without giving the individual—or the operator and machine—adequate time to respond, then an accident occurred. Warning was a term which implied perception. The signs and signals might have been present much earlier but unappreciated either through ignorance or they may have been obscured. Thus there were two main tasks at the other end of this time gap: one of education or training to look for signals, to find the best methods of developing skill; and the other to ensure that the signals had full information content, and were properly displayed.

The author did not think the earlier hope of a selection process to exclude the accident-prone would come to fruition, except in highly specialised occupations demanding great skill and responsibility for the safety of others. Prediction was statistically possible, and significantly so, but it was not efficient enough to warrant its use except in occupations where expense of time or money or rejection of suitable applicants was more than offset by the need for choosing only the safest of men. Even if prediction had greater statistical validity than it had, selection would merely alter the problem; the accident-prone existed and could not be denied the right to earn their living. Furthermore, a policy of rejection of men seemed out of place in a full-employment economy.

He thought that more development was coming at the other end, aimed at modifying working situations so that a wider range of individuals could work efficiently and safely. Even if the accident-prone man still continued to have more accidents than his fellows, if the overall hazard was reduced his gain was proportionately the greater. This development was dependent on research and application on, among others, some of the lines he had mentioned. Further work was needed on the inter-relation of human and machine response constants to increase our knowledge of the desirable qualities of machine control; on information content in relation to modes of display; on the effects of environmental and social variables on performance; and on the fundamentals of industrial training.

There followed a luncheon for members and their ladies as guests of the North-Eastern Division of the National Coal Board. In the evening of the same day the final event of the conference was the President's reception, annual banquet and ball. Both the luncheon and the evening function were held at the Majestic Hotel.

At the luncheon, Mr. A. Scott, B.Sc., M.I.Min.E., production director, North Eastern Division, N.C.B., took the chair. Mr. Morton, the president, in proposing "The North Eastern Division, N.C.B.," said that the Board had been generous in its training schemes. The Association appealed for quality rather than for numbers and they wanted more of the young men passing through the Board's training schemes to join them.

In reply Mr. Scott said that the Institution of Mining Engineers had started a junior section, and he thought that something similar could be done by the A.M.E.M.E.

Mr. Morton presided at the dinner when the guest of honour was Lord Milner of Leeds, who proposed the toast of the Association. He thought that the president was right in stressing in his address the importance of the right guidance to youth.

In reply, the president, quoting the Prime Minister, said the prizes of the world would go to those with the best systems of education. There had always been a deficiency of trained technical men in the mining industry, and the Association provided an excellent platform in the training of engineers at all levels.

Mr. B. L. Metcalf, proposing the health of the guests, said relations of the Association with the N.C.B. were very happy ones. In Russia recently he had been impressed by the spirit of service to industry of the people. He looked forward to a revival of that spirit in this country.

In reply, Mr. J. Latham, C.B.E., deputy chairman, N.C.B., said that Mr. Metcalf had added distinction to the mining industry by his recent presentation of the Faraday Lecture. The N.C.B. must see to it that their mechanical and electrical engineers had a proper status.

South Eastern Board's Position

AT Brighton last week the thirteenth meeting of representatives of the South Eastern Electricity Board and of electrical manufacturers was held under the chairmanship of Mr. W. R. T. Skinner, deputy-chairman of the Board.

As is customary, Mr. Skinner opened by reporting on the Board's progress in 1955-56. The net surplus, he said, had by no means disappeared but it was not so great as in the previous year. This was attributable to several identifiable factors, amongst which was the extremely cold spell last February. This year, in particular, the Board had suffered especially from changes in purchase tax and hire-purchase terms and from advertising and capital investment limitations.

Mr. Skinner said that between October, 1954, and February, 1955 (of which only the last four days were affected by the Hire Purchase Control Order), the value of sales of new apparatus and fittings was 65.4 per cent greater than in the corresponding five months of the year before. In the following five months (March to July, 1955) sales continued to increase, but at the more modest rate of 26.8 per cent. There was some difficulty in giving a reliable assessment of the results of the July Order, for in October the Board's trading figures were quite artificial because of anticipation of the Autumn Budget. In that month they reached the unprecedented height of over £305,000 worth of sales in a single month, an all-time record, but an unhealthy record which was followed by a sharp slump in the next month. The July Order, however, still did not produce a decrease but it reduced the increase to 7 per cent compared with 27 per cent for the previous five months.

The three months following the Budget showed an average decrease compared with the year before of a little over 4 per cent. Then, in February this year, came the third change in hire-purchase terms and the fourth repressive measure on sales in less than twelve months. Averaged over March and April the rate of decrease was increased from 4 per cent to just over 14 per cent.

The total number of new consumers in 1955-56 was a trifle under 36,000, compared with 37,000 in 1954-55. This was not so good as was hoped for, or expected, but it was the second largest number the Board had con-

nected in a year. The slow downward trend seemed to be continuing and the nearest forecast Mr. Skinner could make would be that the Board might possibly connect between 30,000 and 35,000 consumers this year.

About three out of every four farms in the area were now supplied with electricity. Since April, 1948, the number of farm consumers had increased by 71 per cent compared with a 31.5 per cent increase in all consumers, thus maintaining the ratio of 2¼:1 in the rate of their rural development as compared with total development. The task of changing over d.c. supplies to a.c. was a very considerable one, but the number of d.c. consumers had been lowered by 40,000. The reduction in number was at present a little under 8,000 a year.

Construction of 33 kV primary transmission lines, the extension, reinforcement and improvement of the remainder of the Board's system and the change-over from d.c. to a.c. had necessitated the laying of 639 miles of new mains and the establishment of 970 new sub-stations, both new records for a year's work. Mr. Skinner concluded with a reference to the Herbert Committee's Report and said that it was gratifying to see that it contained a great deal of refreshing common sense. He understood that about a fifth of all the visits the Committee paid were to the South Eastern Board.

This year there were no written questions, but in a verbal question Mr. Skinner was asked what plans the Board had for a nine months' credit scheme. In reply Mr. Skinner said that they had not yet settled any plans and were waiting a few months to see what happened to sales figures. The matter was, however, under immediate consideration.

Claim Against London Board Fails

Conditions of Payment of Co-partnership Bonus

ON 15th June, at the end of a hearing which had occupied twelve working days, Mr. Justice Pearson gave judgment for the defendants in the case of *Ardley and Morey* v. *London Electricity Board*. As already reported, the plaintiffs claimed sums alleged to be due to them under the defendants' co-partnership scheme, which sums had been withheld because of the plaintiff's part in the meter readers' strike of January, 1952. The evidence having been completed at the end of the previous week, the last four days of the hearing were taken up with counsel's closing speeches, Sir Hartley Shawcross, Q.C., who addressed the Court on behalf of the defendants, being followed by Mr. M. R. Nicholas (in the unavoidable absence of Mr. D. N. Pritt, Q.C.) for the plaintiffs.

Mr. Justice Pearson, in giving judgment, began by saying that the plaintiffs had a prima facie right to the bonus they claimed. The defendants relied on clause 4 of the co-partnership agreement, which set out conditions as to an employee's entitlement to bonus and provided, *inter alia*, that should he break his service agreement by going on strike without proper notice he would lose his bonus for the period from the beginning of the bonus year to the date he went on strike. They also relied on rule 2 of the rules of the scheme, which provided that the Board reserved a right to decline to allow employees who were wasteful, or who were careless or negligent in the performance of their duties, to share in the scheme. His Lordship dealt with the plaintiffs' contention that the rules were *ultra vires* the agreement by holding that, on the evidence, the rules and the agreement were intended to be read together as one.

Dealing with clause 4, his Lordship referred to a difficulty of interpretation in that an act of going on strike did not "break" or terminate a service agreement. All that happened was that the employee, in ceasing to perform his part, gave his employer the right to dismiss him, which right might or might not be exercised. But as such clauses had to be interpreted benevolently towards the employee and as he (his Lordship) had no doubt that the intention in this case was that an unlawfully striking employee should lose his bonus, he held that, on the true construction of the clause, the plaintiff Ardley had lost his right to bonus from 1st April, 1951, to 1st January, 1952, and the plaintiff Morey from 1st April, 1951, to 7th January, 1952.

With regard to rule 2, his Lordship considered the plaintiffs' argument that the power conferred on the Board was one which, to be validly exercised, would have to be exercised in a judicial manner in accordance with the rules of natural justice (i.e., allowing the employee to plead his case). But the function of the Board under this rule was an administrative one in that it had to decide a question of policy; whether or not it had complied with the rule in this case did not, therefore, arise. He, his Lordship, was satisfied that the requisite decision had been made by the Board.

After saying that political matters were excluded from the trial as being outside the scope of the action, and having dealt with the evidence, in the course of which he said that, although he had no doubt about Mr. Foulkes' honesty and personal integrity, he was unsuccessful as a witness and was defeated in cross-examination, his Lordship then dealt with the cause and events of the strike. The important event was the meeting on January 22nd, 1952, in the course of which meeting the trade union side said they would agree to the Board's proposals provided undertakings were given in regard to co-partnership bonus and sick pay. The Board agreed to give an undertaking about sick pay, but made what was referred to as a "declaration" on the co-partnership question. This was: "In the expectation that the agreement will operate smoothly and in the spirit in which it has been negotiated, the Board will not exercise its rights to make reductions under the co-partnership scheme."

The agreed Press notice which followed that statement provided for an undertaking by the unions to consider the data on redundancy supplied to them by the Board.

Was that so-called "declaration" intended to have contractual force? In his Lordship's opinion, the wording was not suitable for more than what the defendants had suggested was a "gentleman's agreement," for it was not fully suitable for a contractual provision. There was evidence by both parties that it was not intended that the declaration should create legal relations, and he (his Lordship) held that it had no contractual force. But, his Lordship continued, if he were wrong in that and the declaration was legally binding, then he would hold that the qualifying provision was a condition to the fulfilment of the promise. It was clear that the trade union side took no steps after February 6th, 1952, to fulfil the undertaking to consider the data on redundancy. What had happened was that they tried to get the question of redundancy put back into the normal negotiating machinery, and this was quite inconsistent with the "gentleman's agreement." It was a question of using reasonable endeavours, not of actually coming to an agreement. The "expectation" was not fulfilled and the "agreement" had not operated smoothly and in the spirit in which it had been negotiated.

The result was that the claim failed and judgment was given for the Board with costs.

Geneva Tariff Negotiations

Reductions in U.K. Electrical Import Duties

REDUCTIONS in United Kingdom import duties on a wide range of electrical machinery and apparatus are proposed as a result of the recently concluded tariff negotiations held at Geneva under the General Agreement on Tariffs and Trade (G.A.T.T.). This latest meeting of the contracting parties to the agreement was the fourth general round of international tariff negotiations; previous meetings were held at Geneva (1947), Annecy (1949) and Torquay (1950/51). The negotiations forming the subject of the present review were initiated following the passage through the United States Congress of legislation authorising tariff reductions up to 15 per cent during the next three years.

A report on the conclusion of the 1956 negotiations, with the text of the protocol, was recently published by H.M. Government as a White Paper (Cmd. 9779, price 6d) but the tariff schedules annexed to it are being published separately on account of their bulk.

The accompanying table, compiled from an advance copy of the schedules, lists the more important concessions which the United Kingdom proposes to bring into effect as a result of the agreements made at the conference. In addition to the items detailed in the accompanying table small reductions have been agreed in respect of the *ad valorem* duties on dynamo lighting sets for bicycles, from 30 per cent to 27½ per cent, leaving the (alternative) specific duty of 2s 6d per set unchanged; duties on certain classes of agricultural and dairy machinery are to be reduced from 15 per cent to 12½ per cent. Both the preferential and full rates of duty on amplifiers and loudspeakers, as well as on wire and tape recorders and reproducers, are also to be reduced. The proposed new duties are: preferential 13⅓ per cent (16⅔ per cent); full 20 per cent (25 per cent). The figures in brackets represent the present rates.

Concessions agreed upon will become effective on the thirtieth day after each contracting party signifies its intention of bringing them into force. At first sight the United Kingdom appears to have conceded more than her fair share on the electrical side, but these reductions must not be viewed in isolation. In the first place the U.K. duty of 20 per cent on most items of electrical and other machinery is on the high side as compared with corresponding duties levied by other countries. For instance, the maximum rate of duty on motors, generators and transformers entering Western Germany is 10 per cent and the Benelux countries 12 per cent. Electric motors and transformers entering the United States pay a duty of 12½ per cent and on entry into Denmark the duty is as low as 7½ per cent. Further examples such as these are not hard to find.

Bargaining on tariffs does not necessarily take place one country with another on an item for item basis. If the United Kingdom gains a concession in respect of electric washing machines in one country this does not imply that it will make a corresponding concession. In return for such a concession the United Kingdom might make an offer of a reduction in duties in a different section of industry altogether.

Principle of Concessions

Under the rules of G.A.T.T. any concession obtained by one country has to be made available to all the other countries subscribing to the agreement. Thus, if the United Kingdom persuaded the United States to reduce her duties on electric motors, then that concession would be shared by all other G.A.T.T. countries exporting to America, although various escape clauses exist in the agreement which enable contracting parties to withhold concessions in certain circumstances.

As the White Paper makes clear, in exchange for concessions granted by the United Kingdom covering imports

Proposed United Kingdom Concessions

Tariff Item No. Part and Group	Description	Proposed New Rate of Duty (present rates in brackets)	
3 X (1)	Steam turbines; water turbines	17½%	(20%)
3 X (1)	Electrical machinery, the following:— Electric motors (other than cinematograph motors, toys and parts of toys, of musical instruments or of clocks) not exceeding 250 h.p.; and parts thereof. Rotary convertors. Electric generators and parts[1]	17½%	(20%)
3 X (1)	Wire winding machines	17½%	(20%)
3 X (1)	Portable power tools, electric, and parts thereof	17½%	(20%)
3 X (1)	Parts of power pumps	17½%	*
3 X (1)	Food and drink preparing machines (non-domestic)	17½%	(20%)
3 X (1)	Electrically operated machines of the types used for domestic and household purposes, the following:— Bread buttering and slicing machines, fans, floor polishers, floor scrubbers, hair dryers, knife cleaners, knife sharpeners and vegetable peelers	17½%	(20%)
3 X (1)	Electrically operated machines, the following:— Hand and face dryers, hedge trimmers, lawn mowers and shoe polishers	17½%	(20%)
3 X (1)	Parts of the machines listed in the two preceding items and parts of (a) machines of the types used for domestic and household purposes, the following:— Food grinders or slicers, fruit juice extractors, electrically operated food mixers, electrically operated dish washers, electrically operated drink mixers and electrically operated refuse disposal units		
3 X (1)	(b) electrically operated hair clippers, dry shavers and vacuum cleaners	17½%	†
3 X (1)	Parts of refrigerating machines	17½%	†
5 (KID)	Echo sounding apparatus	25%	(33⅓%)
3 IX (1) (i)	Electric wire and cable, insulated, but not including wire insulated only with enamel, varnish or lacquer	17½%	(20%)
3 VII (2) } 3 X (1) }	Electrical goods, the following:— Mercury arc rectifiers, being rectifiers with mercury pool cathodes. Transformers rated at not less than 1 K.V.A. on continuous load, but not including articles liable on 23rd May, 1956, to duty under the Safeguarding of Industries Act, 1921[2]	17½%	(20%)
3IX(1)(iii)	Wireless apparatus, the following:— Radio (including radar and television) transmitting sets, receiving sets and combined transmitting and receiving sets, other than:— (i) receiving sets of the domestic or portable type. (ii) transmitting sets and receiving sets, designed or adapted for fitting to motor vehicles	17½%	(20%)

Notes:

[1] Excluding electric motor and generator casings and unwound rotors and stators dutiable at 10%.

[2] This has the effect of excepting certain instrument and radio transformers, dutiable at 33⅓%.

* Complete machines are dutiable at 17½%. † Complete machines listed under (a) and (b) and refrigerators complete, remain dutiable at 15%.

to a value of about £94 million in terms of 1954 trade, the country's exports stand to benefit from concessions covering imports into the negotiating countries to a total value of £104 million, also measured in terms of 1954 trade. For instance, United Kingdom products on which Germany intends to reduce duties include not only electric washing machines but, *inter alia*, motor cars and motor cycles and certain textiles. Similarly, the American concessions include duty reductions on, for example, electric motors and such things as aeroplanes and Scotch whisky.

Altogether twenty-two nations took part in the negotiations. As some of the schedules of concessions, including the "binding" of duties at current levels, are somewhat lengthy, these will be summarised in a forthcoming issue of the *Electrical Review*.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

"How Low is a Safe Voltage?"

I AM in full agreement with Mr. R. E. Jennings' comments and confirm that a device with a monitored earth leakage circuit would represent greater reliability than the smaller device I advocated in my article. But I also looked at the cost: it might be said that cost considerations should not apply to matters like the operative's safety, but until the use of either device is made compulsory economic considerations will apply in many cases.

Coming down to rough figures: a simple leakage trip with 13-A socket-outlet would cost about a couple of pounds, against the monitored trip at £10-£12, which still protects only one tool. I think I should prefer, say, 80 per cent safety applied to a great number of portable tool points to, say, 95 per cent applied to a much smaller number, as the overall picture would be improved. The monitored device is, of course, the last word in safety considerations, but I am afraid that only the larger industrial establishments would be able to afford them in the large numbers required.

Elham, Kent. T. C. GILBERT, M.I.E.E.

Street Lighting

MR. WHITTAKER and I are without doubt at one regarding the advantage of using sodium lamps over high-pressure mercury vapour for street lighting, and it is only regarding details that we are at variance. Even here it is only on one point, and that is in connection with his contention that the reason for the superiority of sodium is the superior response of the eye to colour in the region of 5,700Å. That the eye is more susceptible at this wavelength is, of course, a fact. I think the point at issue is how the luminous output of a colour source is assessed, and here I think we should refer to the definition of luminous flux as agreed by the C.I.E. at Stockholm in 1951, which reads as follows:—

> "That characteristic of an energy flux which expresses the visual sensation produced by it, evaluated according to the values of *relative luminous efficiency*" [as adopted by the C.I.E.].

To my way of thinking this definition makes allowance for colour, as indicated by my underlining of the relevant words. I assume, therefore, that the tests carried out by Messrs. Ferguson and Stevens made due allowance for the difference in colour of the two light sources.

I still maintain that the chief reason for the superiority of sodium is the apparent smaller amount of glare, and this, as I stated in my previous letter, I feel to be a psychological condition. Speaking personally, I should be only too pleased to see all main-road lighting performed by sodium lamps, since I feel that this source is undoubtedly superior both from the economical and performance standpoint.

I am well aware that I, an engineer, am treading on that dangerous ground which is the domain of the physicist and eye specialist, and therefore form an easy target for their sport.

Cardiff. F. H. PULVERMACHER.

Paper Capacitors

AMONG the recently issued publications of the British Standards Institution, B.S. 2131: "Fixed Paper-Dielectric Capacitors for D.C. for Use in Telecommunication and Allied Electronic Equipment," is the first of a series of the standards dealing with components for telecommunication and allied electronic equipment. It applies to fixed capacitors using impregnated paper-dielectric and metal foils electrodes and suitable for d.c. operation with or without a small superimposed a.c. component; its requirements are applicable to capacitors of equivalent performance having other dielectrics.

The capacitors covered by the standard comprise a range from which may be chosen capacitors for use over almost any desired range of temperature and humidity. In this way widely varying conditions of use are catered for, extending, for example, from use by the Services under extreme conditions to domestic-receiver use in temperate climates. Capacitors suitable for different types of use are identified by an indication of the temperature category and humidity classification.

Use of the standard requires reference to B.S. 2011: "Basic Climatic and Durability Tests for Components," which fully describes the range of tests to which components may be subjected, in accordance with the requirements of the standard specifications for the individual component.

The object of the tests on components is to establish as far as is possible under laboratory conditions (a) their suitability for use over stated ranges of temperature and humidity; (b) their ability to withstand specified conditions of mechanical shock, such as are to be expected in transit or under operational conditions; and (c) their ability to withstand normal assembly processes (e.g., soldering) attendant on their incorporation in equipments, without detriment to (a) and (b) above.

Some tests in the standard are accelerated tests, or tests under conditions which may represent or even exceed the most severe conditions of use. Such tests establish arbitrary standards of quality but they cannot be held to give positive information on any performance beyond or outside the test periods or test conditions.

It is intended at a later date to add a further part to the standard which will specify standard sizes, ratings, etc., of the capacitors. Copies of the standard may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 3s 6d.

VIEWS on the NEWS

By REFLECTOR

TROLLEY-BUSES are too often unfairly vilified by advocates of oil-engined vehicles but it is going a bit too far when disparaging remarks are made about them when they do not exist. Mr. W. H. Smith, manager of Birmingham City Transport, complains to the N.A.L.G.O., journal *Public Service* that in its April issue it published a cartoon purporting to represent a City of Birmingham trolley-bus with the note "In many towns the trolley-buses are virtually silent. Surely it is not beyond the ingenuity of Birmingham to stop the awful screech now made as the conductor runs along the overhead wire." Of course it was "the conductor running along the overhead wire" which inspired the cartoonist. Mr. Smith points out that Birmingham abandoned trolley-buses in 1951 and he indignantly says that the system now consists wholly of motor buses "which experts regard as the finest in the country."

★ ★ ★

Residents of Drummond Place, Edinburgh, are complaining of new electric lamp standards, which are said to affect the dignity of the locality. As I have not seen these standards I cannot pass an opinion on them. What interests me is that one correspondent on the subject to the *Edinburgh Evening News* mentions a rather pleasant custom of the city. He says that when a town councillor becomes Lord Provost two ornate lamp standards are placed outside his house and, similarly, a standard is erected outside the residence of a newly appointed magistrate. He hopes that these ornate standards will not be removed one day and replaced by modern ones. "Modern" lamp standards can be of good design but there are too many which are not. Some that are pleasing to the eye occasionally find themselves in incongruous settings and are thereby made to look hideous.

★ ★ ★

While on the subject of lamp standards I should mention the case of the lighting on a housing estate at Wilmington (Kent). There the Residents' Association addressed a letter to the Parish Council asking it to request the South Eastern Electricity Board to prepare a lighting scheme for the estate. It was stipulated, however, that before the scheme was proceeded with the Association would like to see it as they had "definite ideas regarding the type of standards they would wish to have erected." The chairman of the Council is reported by the *Erith Observer* to have remarked at a meeting: "This request does not look very nice on paper. In fact, it looks very bad." Another member said that if people in other parts of the village saw this they would ask for the same. While I think that inhabitants of a district might be given a say in such a matter I can quite appreciate what a situation might arise if every man had the lamp-post of his choice.

★ ★ ★

Fuel is such a burning topic that practically everybody concerned with the subject (and who isn't nowadays?) seems to produce a booklet about it. I have just received such a publication from the Conservative Political Centre ("Fuel for the Future," by Anthony Greenland, price 9d). This is a convenient summary of the position and prospects, factual and objective. Coming from such a source, it must not be condemned for the very light taps it inflicts on nationalised industries. Too much stress is perhaps laid on the possibilities of district heating and the implied reproach of the Central Electricity Authority for not doing more in this way during its nine years' existence is not entirely deserved in view of the Authority's preoccupation with its main business of producing enough power under rather severe handicaps.

★ ★ ★

The *Manchester Guardian* reports the sad case of a woman who, given an optimistic weather forecast by the Post Office, proceeded with her washing only to have it drenched by a downpour of rain. She told the supervisor of her local telephone exchange that she had endeavoured to remonstrate with the "forecaster" who, she said, had shown complete indifference to her protests. It had to be explained to her that the forecast was an automatically reproduced recording. Formerly it was said of limited companies and Government Departments that they "had no bodies to be kicked or souls to be damned." All that is now changed (I hope) in this more enlightened age, but is this Post Office incident a foretaste of future public relations?

★ ★ ★

Mr. J. E. Edgecombe, borough electrical engineer of Kingston-on-Thames, who was president of the Municipal Electrical Association half a century ago, was a man after the electrical contractor's own heart. In his presidential address, as reported in the *Electrical Review* of 22nd June, 1906, he said:—

> "Although I do not propose to set forth here any opinion as to the merits or demerits of municipal trading as a whole . . . I would suggest that local authorities having entered into an agreement with new consumers to enable them to spread the cost of the work over a number of years on the basis of a deferred payment system, and having ascertained the requirements of such consumers, should prepare a specification of the work required, and, instead of then proceeding to carry out the work, should obtain tenders from suitable contractors, and having supervised the carrying out of such work, should be prepared to make the necessary payments to the contractor on the completion of the work. This arrangement is obviously to the advantage of the consumer, as he is enabled to spread the cost of the installation over a period of years. He knows that his work has been carried out to a satisfactory specification, under proper supervision and probably at a lower cost than would otherwise be the case, as obviously no extra sum on account of risk of bad debts need be included in the contractor's tender to the municipality for the work to be carried out on the consumer's behalf; whilst, on the other hand, the contractor would have no reason to complain that the municipality were entering into direct competition with him, as might be the case if the staff of the local authorities were to carry out the work."

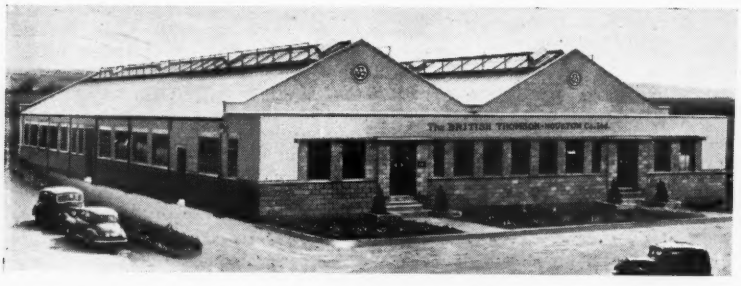
INDUSTRIAL NEWS

New B.T.H. Lamp Works

On Tuesday last the new B.T.H. Lamp Works at Buckie, Banffshire, were officially opened by Mr. Peter Reid, Provost of Buckie, who was introduced by Lord Chandos, chairman, British Thomson-Houston Co., Ltd. At the luncheon which preceded the opening ceremony, the principal speakers were Lord Chandos, Mr. T. Johnston (chairman, North of Scotland Hydro-Electric Board) and Sir Robert A. Maclean (chairman, Scottish Industrial Estates).

The establishment of these electric lamp works in Buckie is regarded as an important contribution to industry in that part of the country, where additional light industries are being mtroduced to offset the adverse effects resulting from part-time working in some of the old-established staple industries of Scotland. In recent years the B.T.H. Co. has undertaken the responsibility for the manufacture of all electric lamps marketed under the four brand names of "Mazda," "Siemens," "Ediswan," and "Metro-Vick" within the A.E.I. group of companies. There are certain special types of lamps which either because of small requirements or constructional complexity require a considerable amount of delicate skilled hand assembly. It is with this type of product that the Marchmont Works at Buckie will be concerned. Small telephone-switchboard lamps will be made at the new works as they need a high labour requirement for a small bulk of raw material and finished product. Having first established the manufacture of this type, other, and somewhat similar, production lines will follow; but again of those types where the direct-labour content is high for the volume of finished product.

This factory is the first completely new project to be built by Scottish Industrial Estates outside the Development Area, and marks a turning point in the B.T.H. Co.'s activities. It comprises four units and has a total floor area of approximately 20,000 sq ft. The main contractors, on behalf of Scottish Industrial Estates, Ltd., are the Don (Contractors), Ltd., of Inverurie; the architects are A. Marshall Mackenzie & Son, Aberdeen; and the engineering consultants are Hulley & Kirkwood, of Glasgow. Equipment installed in the factory for the manufacture of the telephone switchboard lamps includes the most modern types of glass sealing and lamp exhausting machines.



The new B.T.H. Works at Buckie

Transformers for T.V.A.

A contract for the manufacture and delivery to site of two 200,000 kVA, three-phase, 60 c/s 154/13.8 kV transformers has been awarded to the English Electric Export and Trading Co., Ltd., by the Tennessee Valley Authority of Chattanooga for the Reynolds power sub-station. The value of the contract is approximately £200,000 and the transformers will be manufactured at the company's Stafford Works. This is the third order to be placed with English Electric by the Tennessee Valley Authority; the previous two contracts cover equipment for the Rockwood and Johnsonville power stations.

National Gallery Extensions

On June 15th the National Gallery reopened six more exhibition rooms which have been closed to the public since the war. Three have been repaired and redecorated and the other three entirely remodelled and air-conditioned, bringing to completion the first phase of the reconstruction and improvement of the Gallery begun in 1946. All the lighting and air-conditioning has been designed by the Ministry of Works and carried out under its supervision. The Norris Warming Co. was responsible for the air-conditioning, the lighting fittings were made by F. H. Pride & Co., Ltd., and the fluorescent control gear by Inductive Appliances, Ltd.; the installations were carried out by Read & Partners.

The air-conditioning plant which was planned to serve all six rooms was installed in 1946-47 and put into operation in Gallery XXIX in 1950. It is housed at the rear of the West Wing and provides clean air which is stable in temperature (63 deg F) and in relative humidity (58 per cent), thus permitting the removal of glass from the cleaned and varnished paintings.

The cleaner and more consistent atmosphere will not only greatly prolong the life of the pictures, but the use of comparatively expensive wall-coverings as damask has been made possible, and it is claimed that "museum fatigue" will be reduced. The lighting system in Gallery XXIX has also been extended.

In five of the six remodelled rooms the direct sunlight through the sloping glass roofs has been modified by horizontal lay-light ceilings hung below them. The lay-light louvres conceal fluorescent tubes which at night light the walls with an even brilliance, while the source of the lighting is virtually invisible. With all the lamps on at night the intensity of illumination is from 15 to 20 lumens. The rectangular arrangement of louvres conceals five continuous lines of fluorescent lamps and these are of the type used for colour matching and consist of 40 W and 80 W tubes.

In the sixth room (No. XXVII), which is small and octagonal and where sufficient daylight was the problem, internally mirrored tungsten filament lamps are used, housed in a louvred recess at the lower end of the sloping glass roof panels. There are five batteries of six lamps—three 230 V and three 24 V each of 150 W rating; sixteen 80 W fluorescent lamps are housed in pairs over each roof panel to give general illumination and reduce glare. In the remainder of the gallery, where the ceilings are still mostly of great height, the problem of effective lighting has not yet been satisfactorily solved. Until lower ceilings are built lamps in double-sided hanging fixtures have been introduced each consisting of six 80 W fluorescent lamps and eight 75 W tungsten lamps.

It is hoped eventually to extend the air-conditioning and lay-lighting to the rest of the Gallery.

Preserving Rural England

At last week's annual meeting the Council for the Preservation of Rural England presented its annual report which, as usual, contains a number of references to electrical works—mainly overhead lines—in which action has been taken. Again the Council records that while in many cases reasonable compromises can be found and Electricity Boards are ready to make concessions to the claims of amenity, there are occasions on which the Planning Authority and the Electricity Board cannot agree "and sometimes, because of local pressure and understandable impatience on the part of those who need electricity, the Planning

Mr. W. H. McFadzean (left), chairman and managing director of B.I.C.C., and Mr. A. R. Leith, Regional Manager (Midlands), with the B.I.C.C. travelling display of mineral-insulated cables.

Authority, against their better judgment, give way." The Council registers its determination, where circumstances demand it, to express and urge its views at the highest level.

Only one power station, Staythorpe, is mentioned in the report. Here the Minister of Fuel and Power, after a public inquiry, sanctioned the erection of natural draught cooling towers.

A new matter with which the Council is becoming concerned is the erection of nuclear power stations. The official statement that these stations must for the time being be placed in reasonably remote rural areas is held to imply a "widespread threat to the English countryside" and the Council has felt bound to oppose their siting in the open countryside.

International Contractors' Association

Some time ago we reported the formation of an International Association of Electrical Contractors in which contractors in Great Britain, France, Italy, Denmark and Switzerland were participating. At a recent meeting held in Rome it was reported that applications to join the Association had been received from Germany and Austria and an observer from the United States was present at the meeting. Mr. S. L. M. Barlow, A.M.I.E.E., the past-president of the Electrical Contractors' Association, was elected president in succession to Mr. Dusserre (Switzerland) and Mr. L. C. Penwill, C.B.E., director and secretary of the E.C.A., was re-elected treasurer. The vice-presidents are Messrs. Favero (Italy) and Repsdorph (Denmark).

Work has begun on a number of surveys and these are in the hands of the following:—Mr. Dusserre, economics; Mr. Huguet (France), technical matters; Mr. Repsdorph, social matters; and Mr. Grandvoinet (France), information.

B.I.C.C. Travelling Display

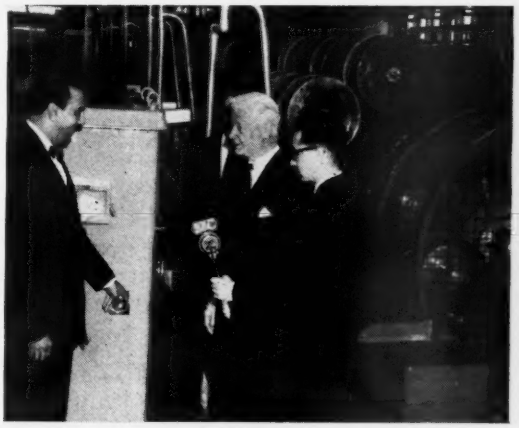
The display caravan introduced by British Insulated Callender's Cables, Ltd., last year has commenced a second tour. It has been completely re-equipped for this tour, which will cover the whole of the United Kingdom, and will have as its theme mineral-insulated cables. The tour started at Gloucester. The exhibition comprises a comprehensive selection of C.M.A. mineral-insulated cables and their accessories, and illustrates processes in the manufacture, and typical applications of these cables. As a further aid to the potential user, a new and simplified method of terminating mineral-insulated cable is explained by means of a sound film in colour, projected by an automatic back-projection unit installed in the caravan.

E.A.W. Activities

The Great Yarmouth and Coventry Branches of the Electrical Association for Women recently celebrated their twenty-first birthdays. The inaugural meeting of the Grimsby Branch was held on 15th May. The chairman of the Branch is Miss Chandler, and the hon. treasurer is Mrs. Lancaster.

Works Visit

The Colombian Ambassador, Senor J. M. Villarreal, recently visited the Dagenham works of W. T. Henley's Telegraph Works Co., Ltd., to witness the commencement of the second million dollar telephone cable contract secured by Henley's for the Bogota Telephone Co. In the accompanying picture the Ambassador and Sir John Dalton (chairman of Henley's) are seen in the works recording messages for the Latin-American services of the B.B.C.



Left to right: Senor J. M. Villarreal, Colombian Ambassador, Mr. A. F. Lampitt, Sir John Dalton (chairman of Henley's), and Mr. Aguileia (Latin-American services, B.B.C.), at Henley's Dagenham works.

"John Biscoe" Propulsion

All diesel-electric propulsion and auxiliary power equipment for the new 800-ton Falkland Islands Dependencies ship *John Biscoe* is being supplied by the General Electric Co., Ltd. The ship, which has been built by Fleming and Ferguson, Ltd., Paisley, was launched on 11th June by Lady Patricia Lennox-Boyd, wife of the Secretary of State for the Colonies. It is the first vessel to be designed and built specifically for the Antarctic relief duties of the Falkland Islands Dependencies Survey. The propulsion equipment comprises two main engine-generator sets powered by National Gas diesel engines, supplying a 1,450 s.h.p. double-armature motor, driving a single screw. In addition, the G.E.C. is supplying all the generating sets, switchgear and galley equipment for the new ship.

Hire-Purchase in Sweden

The *Anglo-Swedish Review* mentions that by agreement between the Swedish Department of Trade and the National Association of Wireless Dealers the minimum initial cash payment for table-type radio sets sold on hire-purchase terms is fixed at 40 per cent of the total price and the maximum term at ten months (formerly 20 per cent and twelve months). For radio-gramophones and television sets of the "furniture type" the initial cash payment is 35 per cent and the maximum term twelve months.

Elliott Bros. Agreement

Under an arrangement arrived at between Elliott Bros. (London), Ltd., and the National Cash Register Co., Ltd., National Cash Register will market in this country the Elliott "405" electronic data processing systems for business and accounting applications. The arrangement between the two companies applies solely to the business and accounting applications of the "405" machine, and Elliott Bros. will continue to

market their analogue and digital computers for all scientific and industrial applications and will be responsible for "405" equipment already in hand.

Transformers for the "Bergensfjord"

Foster Transformers, Ltd., have supplied twenty-four transformers having ratings between 12.5 kVA and 50 kVA to the Norske Americalinje ship *Bergensfjord* (Swan, Hunter & Wigham Richardson, Ltd.).

All these transformers are of the single phase, double wound, naturally air-cooled core design, indoor, type having primary windings for 440 V, 60 c/s and secondary windings for 123 V, no load, 60 c/s.

Power facilities are divided into five vertical sections, each section's lighting, small power and small cooking facilities being fed from one bank of transformers. An emergency bank of transformers feed distinct emergency lighting including the navigation lights and other essential low-voltage services throughout the ship.

Drill Company's New Premises

The new head office and showrooms of Monks & Crane, Ltd., twist drill specialists, at Garretts Green Lane, Birmingham, were opened on Friday last week by Alderman A. F. Bradbeer, J.P., representing the Lord Mayor of Birmingham. Contemporary design and decoration is the keynote of these new premises and with the increased facilities now available the company will be able to hold increased stocks of an exceptional range of twist drills, reamers, milling cutters, taps and dies, hacksaw blades, files and the like. The new premises are set in delightful country surroundings yet within easy access to Birmingham and Midland industries.

The opening ceremony was followed by a lunch at the Grand Hotel, Birmingham, presided over by the chairman of the company, Mr. B. C. Kirk, J.P., F.C.A., supported by Alderman A. F. Bradbeer, Sir Edward C. G. Boyle, Bt., M.P., Economic Secretary to the Treasury, Miss Edith M. Pitt, O.B.E., M.P., Parliamentary Secretary to the Ministry of Pensions and National Insurance, and many noted personalities in Midlands industrial circles. After the loyal toast had been proposed by the chairman, the toast of the "City of Birmingham" was proposed by Miss Edith Pitt and replied to by Alderman Bradbeer. The toast of "British Industry" was proposed by Sir Edward Boyle and replied to by Mr. E. C. Martin, joint managing director of the company. The toast of "The Guests" was proposed by Mr. D. W. Thomas, joint managing director of the company, and the response was made by Mr. E. M. Clayson, managing director, Birmingham Post and Mail, Ltd.

Instrument Makers' Agreement

R. B. Pullin & Co., Ltd., have concluded an agreement with the American Kearfott Co. for the manufacture in this country of a range of Kearfott products including synchros, servomotors and other high precision mechanical, electrical and electronic components. Manufacture will take place in new buildings which are being erected at Pullin's Phoenix Works on the Great West Road, thus enabling the manufacturing resources to be further utilised for the production and sale of products already in general use by the U.S. Government and many corporations in North America. The Kearfott Co. is a subsidiary of the General Precision Equipment Corporation Group.

Price Correction

In our issue of 15th June, page 1,061, a description was given of the new "Firefly" 1 kW electric fire manufactured by the Falkirk Iron Co., Ltd., Falkirk, Stirlingshire. We are now advised that the correct price of this fire is £2 1s plus 18s purchase tax and not £1 19s plus 17s 1d as stated.

Philips' Reactor Claim

In the Chancery Division of the High Court on June 14th Mr. Justice Lloyd-Jacob had before him an application by Philips Electrical, Ltd., relating to a nuclear reaction patent; he adjourned it until 2nd October. The application was for a postponement of the hearing of a petition by Philips Electrical for the extension of a patent concerning "a method for increasing the efficiency of nuclear reactions and the products thereof" until a claim by the company against the United Kingdom Atomic Energy Authority had been disposed of.

Counsel for the company said that the patent covered the use of the moderator in an atomic pile. This had been used by the Atomic Energy Authority and the company was seeking royalty payments. The Authority was contending that the patent was invalid. Saying that the invention was due to Enrico Fermi and his collaborators in Rome, Counsel showed that Philips Electrical, Ltd., had acquired the patent from Philips of Holland.

Objectors to the application were the Atomic Energy Authority, the Central Electricity Authority, English Electric Co., Ltd., the General Electric Co., Ltd., Associated Electrical Industries, Ltd., C. A. Parsons & Co., Ltd., and the John Thompson Nuclear Energy Co., Ltd.

Canadian Union and E.T.U.

The Toronto Branch of the Electrical Workers' Union, Toronto, has asked The British Electrical Trades Union for help in a wage dispute with Ferranti Electrical, Ltd.,

The E.T.U. has replied that the Canadian strike issues would be discussed with the chairman and manager of the company, Sir Vincent de Ferranti. The Toronto branch has stated that, unless a satisfactory conclusion is reached, the E.T.U. would take some action to assist it.

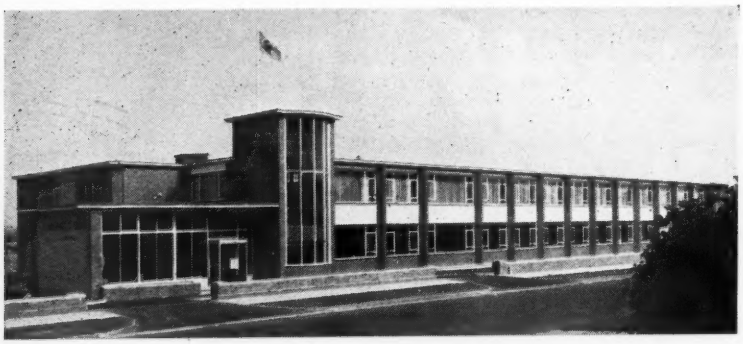
The union wants a 10 cents an hour (about 9d) wage increase, a company paid pension plan, increased welfare benefits and seniority improvements. The company has said it is unable to meet the union's demands because of the highly competitive prices in the Canadian electrical industry and worsening market conditions.

Change of Address

From 25th June the address of the Diesel Engineers' and Users' Association will be 19, Old Queen Street, Westminster, S.W.1 (telephone: Trafalgar 5597).

Trade Annoucements

The A.E.I. Lamp and Lighting Co., Ltd., announces, to clear up any misunderstanding, that the Isle of Man is included in the territory of its North West Region, which is managed by Mr. F. C. Tyrrell from an office at Trafford Park Road, Trafford Park, Manchester (telephone: Trafford Park 3281/3). The assistant regional managers are Mr. C. H. Logan, who is responsible for lighting sales, and Mr. D. J. White, who is responsible for lamp sales. Mr. L. Nuttall, the Liverpool area manager, at 27-29 Stanley Street, Liverpool (telephone: Central 4371/5), is responsible to Mr. White for lamp sales in the island.



The new headquarters of Monks & Crane, Ltd.

GENERATION AND DEVELOPMENT

Higher Charges in Ulster

An increase of 8 per cent in electricity charges is announced by the Electricity Board for Northern Ireland. More than 147,000 consumers in areas outside Belfast are affected. The increase is required to meet rising costs—wages, materials, and interest charges. Mr. James Walker, chairman of the Board, said that tariffs were last raised in 1951. Expenditure was rising faster than income, and an analysis of the increased costs showed them to be in the region of 10 per cent.

Kabaka Switches on Uganda Extension

Electricity was switched on at Masaka, Uganda, on 30th May by the Kabaka of Buganda who in the accompanying photograph is seen blowing out a paraffin lamp as a symbol of the change from old to new. Masaka is about 80 miles south-west of Kampala and 130 miles from the Owen Falls hydro-electric scheme to which it is linked by a transmission line. Mr. W. D. D. Fenton, chairman of the Uganda Electricity Board, tells us that the Board is doing all it can to encourage Africans to use electricity as, ultimately, they will be the largest consumers.

Output in May

The rate of increase in electricity generated in May was well below the average. The total of 6,381 million kWh (see table) was 2.7 per cent more than in the corresponding month of last year compared with an increase in April of 13.9 per cent. In the five months to the end of May 38,536 million kWh was generated, 8.9 per cent more than a year ago.

At the end of May the total capacity of plant installed in stations of the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board was 22,701 MW, a slight reduction on the previous month (22,705 MW). New plant installed was confined to a 240,000 lb/hr Babcock & Wilcox boiler at Staythorpe "A" and Clarke Chapman boilers at Brunswick Wharf (320,000 lb/hr) and Stella South (550,000 lb/hr).

The Kabaka of Buganda blowing out a paraffin lamp after switching on the electricity supply at Masaka. Standing behind the Kabaka is the chairman of the Uganda Electricity Board, Mr. W. D. D. Fenton, and between them the deputy chairman, Mr. Fraser. Seated on Mr. Fenton's left are the Minister of Corporations and Regional Communications (Mr. A. N. Maini) and his wife.

Lapland Power Station

The Rajakoski hydro-electric station in former Finnish, now Russian, Lapland was handed over to Soviet representatives during the last week of May. Work on this station was begun in the autumn of 1952 by the Finnish firm of Imatran Voima. The station is about the same size as those on the River Oulu in Finland. It has a capacity of 41,000 kW and will produce 212 million kWh a year.

Plant for Staythorpe "B"

An order worth more than £3,000,000 has been placed by the Central Electricity Authority with the Metropolitan-Vickers Electrical Co., Ltd. It covers three 120 MW steam turbo-generator sets for installation in Staythorpe "B" power station, now under construction on the north bank of the River Trent, near Newark.

The new sets will run at 3,000 r.p.m. and incorporate turbines of three-cylinder close-coupled design with steam conditions at the turbine stop valve of 1,500 lb/sq in, 1,000 deg F. Six-stage feed-water heating equipment will be supplied, giving a final feed-water temperature of 436 deg F.

The generators are rated at 120 MW at 0.8 p.f. and will be wound for 13.8-kV, three-phase, 50 c/s. They will be hydrogen cooled, the coolers being arranged horizontally in the annular space between the core and the outside of the stator frame. The exciter and pilot exciter will be gear-driven at 1,000 r.p.m. from the main generator shaft.

Transformer for Portobello

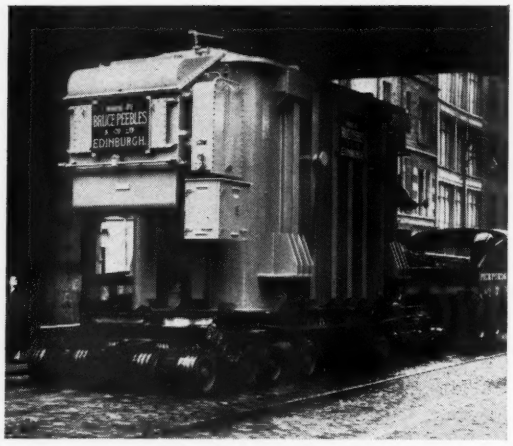
The largest transformer ever to be built in Scotland recently left the works of Bruce Peebles & Co., Ltd., by road for delivery to the Portobello power station of the South of Scotland Electricity Board. The total weight of the complete unit, including its 11,000 gallons of oil is over 150 tons and it measures 30ft long by 19ft high. Two 150 h.p. diesel tractors were used with a 32-wheel trailer and the overall length of the assembly was about 100ft. The transformer has a capacity of 72,000 kVA and will be used in conjunction with the third 60 MW turbo-generator extension at Portobello power station. The transformer, which is fitted with on-load tap changing switchgear on the 132 kV side typifies the current practice of building large units for direct connection of the generator to the 132,000 V grid.

While this is the largest transformer to be built so far, units of 120,000 kVA and of 144,000 kVA have been ordered for service respectively on the Scottish

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity Authority ...	2,946	65	31·3	5,851	3	5,850	5,483	20,761
North of Scotland H.E.B. ...	21	—	1·2	34	76	115	113	722
South of Scotland E.B.	206	6	—	396	9	406	382	1,218
Total for May, 1956	3,173	71	32·5	6,281	88	*6,381	5,978	22,701
Corres. total for May, 1955 ...	3,239	79	18·7	6,102	99	6,214	5,835	20,868
Inc. or dec. per cent.	—2·1	—10.2	+74·0	+2·9	—11·1	+2·7	+2·4	+8·8
Total to date (5 months) 1956...	19,784	421	171·7	37,821	635	38,536	36,231	
Total for corres. 5 months of 1955	18,523	531	110·9	34,697	626	35,398	33,317	
Inc. or dec., per cent.	+6·8	—20·7	+54·9	+9·0	+1·5	+8·9	+8·7	

*The total figure includes generation by other methods amounting to 12 million kWh.



Bruce Peebles 72 MVA 132 kV transformer en route for Portobello power station Photo : the "Scotsman"

end of the 275 kV super-grid and at the new Kincardine power station for connecting a 120 MW generator to the 132 kV grid.

Costs and Tariffs in London

At a meeting of the London Electricity Consultative Council last week it was reported that the Council had considered the question of rising costs, particularly in the field of electricity supply. It had suggested that the Board should issue a public statement to the effect that there would be no increases in charges to consumers over a certain period provided there were no further increases in costs. The Board, while sharing the Council's concern over rising costs, regretted that it could not commit itself in this way but undertook to continue its efforts to keep costs in check by economic management.

Outside Meters

It was stated that the Consultative Council had considered a report by Mr. L. H. Welch, chief engineer of the London Electricity Board, on the subject of fixing meters outside premises. Mr. Welch asked for the support of members in any scheme which the Board might decide upon regarding outside reading positions for meters in all new premises.

Following a general discussion the Council decided to support an experimental scheme, it being understood that the Board had no power to enforce outside metering on any individual consumer.

South Western Farmers' Competition

The provision of electricity in farmhouse and cottage was helping to stem the drift from the land so that skilled workers would be available to produce the extra food the country required, declared Mr. A. N. Irens, chairman of the South Western Electricity Board, at Taunton, when he addressed a meeting of Young Farmers' Clubs' representatives from Somerset, Devon and Cornwall. The meeting was arranged to present awards in a competition which was supported by Young Farmers' Clubs in the area of the South Western Electricity Board. The awards were presented by Miss Gwen Berryman (Radio's "Mrs. Archer"), and the competition was sponsored by the South Western Board.

Competing teams were given the plans of an old and ill-equipped farmhouse, which by thoughtful planning and wise purchasing could be converted into a comfortable labour-saving home. Marks were given for the best selection of equipment and the order in which appliances were installed.

"Pegging" Electricity Prices

The Central Electricity Authority announced on Monday that it had requested the Electricity Boards not to increase their tariffs despite the latest substantial increase in the price of coal. The statement said that the electricity supply industry, recognising the present critical stage of the national economy, and having regard to recent Government statements about steadiness in prices, would carry the added burden, although this would, as Lord Citrine recently stated, seriously reduce the industry's working margin and would involve a number of the Area Boards in individual deficits.

A year ago the industry announced the necessity of augmenting its annual surpluses to provide additional contributions towards financing its capital programme. Further increases during 1955-56 in wages, freight charges, interest rates and the price of coal had prevented the industry from achieving this aim. The latest increase in coal prices would, in the normal course, have necessitated an advance in tariffs generally in order to preserve, at its present modest level, the surplus hitherto achieved by the industry, but apart from the automatic increases which apply to those consumers whose charges were subject to a coal price variation clause, tariffs in general would be maintained at their present level. The South Wales, Yorkshire and North Western Boards had been asked not to proceed with their proposals to raise tariffs.

A.S.E.E. Exhibition

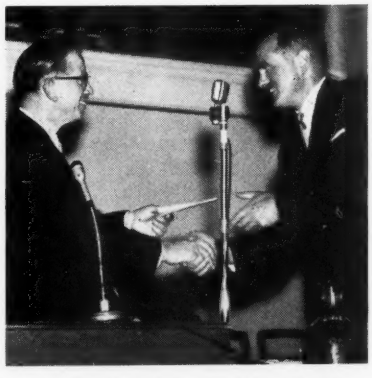
A MEETING of exhibitors in the Electrical Engineers (A.S.E.E.) Exhibition was held at Caxton Hall on 12th June. Mr. J. Flood, the exhibition company chairman, presided and with him were Messrs. E. J. Sutton, exhibition organising chairman, P. A. Thorogood, general manager, and E. A. Bromfield, secretary.

Before the business began the chairman presented to Sir Harold Bishop, president of the Electrical Industries Benevolent Association, a cheque for four hundred guineas, the gross proceeds of a competition held at the fifth Exhibition at Earls Court last March. In accepting the cheque, Sir Harold complimented the sponsors and organisers of the Exhibition and remarked upon the great value of the show to the electrical industry. He also touched upon the work of the E.I.B.A. and expressed the Association's appreciation of the kindness of the organisers in giving it a free stand.

After reviewing the 1956 Exhibition and after the general manager had touched upon certain aspects of the organisation of the display, the chairman called for comments and criticisms and a number of questions were raised and answered. It was also announced that the 1956 Exhibition sound film would be shown at a leading West End Hotel in September.

As exhibitors were taking considerably more floor space next year there was, it was stated, no further room left on the ground floor and expansion to the first floor was, therefore, inevitable. The Organising Committee intended to make "Education Within the Electrical Industry" an attractive feature. Sir David Eccles, Minister of Education, had expressed interest in the proposal.

Dealing with finance, the Exhibition organising chairman stated that the Committee had found it imperative to introduce a nominal increase in stand space charges to meet the substantial increase in general rates, postage and other running costs. Inviting comments on arrangements for the sixth Exhibition, the chairman stated that as a result of a questionnaire sent to 300 exhibitors, there was an overwhelming majority in favour of continuing with a five-day show.



Sir Harold Bishop, president, E.I.B.A., receiving the cheque from Mr. J. Flood.

PERSONAL AND SOCIAL

News of Men and Women in the Industry

The Minister of Fuel and Power has appointed **Sir George Turner,** K.C.B., K.B.E., as a part-time member of the South Western Board. Sir George recently retired from the position of Permanent Under-Secretary of State for War; he was formerly Second Secretary in the Ministry of Supply.

Mr. H. Midgley, O.B.E., M.Sc. (Eng.), M.I.C.E., M.I.E.E., retired from the post of deputy chairman of the South Western Electricity Board on 31st May. His retirement, because of ill health, was foreshadowed some time ago. Mr. Midgley had held the position since the establishment of the Board in 1948 and was not normally due to retire until the end of next year.

Mr. H. Midgley

Mr. Midgley was born at Newcastle-on-Tyne in 1893. He won a scholarship to Rutherford College and later was apprenticed to R. & W. Hawthorn Leslie & Co. He was then awarded another scholarship to Armstrong (now King's) College, Durham University, where he gained the B.Sc.(Engineering) degree, following this up with the external B.Sc.(Eng.) of London University; he proceeded to M.Sc.(Eng.) in 1932. Subsequently he occupied responsible positions with Sir W. G. Armstrong, Whitworth & Co. (Aeroplane Dept.), a firm building concrete ships, the Metropolitan-Vickers Electrical Co. and Liverpool Electricity Department (chief technical assistant). He was appointed city electrical engineer of Plymouth in 1934 and was responsible for maintaining the supply during the severe air raids upon that city. The destruction of the city centre necessitated the replanning of the whole system there and Mr. Midgley dealt with his proposals in an article published in the *Electrical Review* of 24th November, 1944.

Colonel Sir Stanley Angwin is to relinquish, from 30th September next, the post of chairman of the Commonwealth Telecommunications Board, which he has held since 1951. The nomination of a successor is under consideration by the partner Governments who are jointly responsible for the appointment.

The Caroline Haslett Trust has awarded the 12th Travelling Exhibition to **Miss Phyllis E. Grady,** London Electricity Board, Balham. Miss Grady will visit Sweden in the late summer to study domestic electrification in that country. She will give detailed attention to the work of the Swedish housecraft adviser, and to the use made of electricity in Swedish homes, and will also study contemporary domestic lighting.

The Secretary of State for Scotland has appointed **Provost A. Macrae** of Dingwall to be a member of the North of Scotland Hydro-Electric Board for the period until 31st December, 1958.

Mr. M. W. Boyce has been appointed managing director of Black & Decker (Australasia) Pty., Ltd., a subsidiary of the parent company at Towson, United States. He has for the past several years held the post of marketing manager of Black & Decker in this country at Harmondsworth. **Mr. J. P. Jamieson,** who is at present branch manager at the company's Manchester office, will assume the responsibilities of marketing manager at the Harmondsworth factory.

Mr. J. C. Dawson, B.Sc., A.M.I.E.E., has been appointed sales manager, Switchgear Department, of the Metropolitan-Vickers Electrical Co., Ltd., and **Mr. J. E. Stubbs,** B.Sc., A.M.I.E.E., has been appointed engineer-in-charge, switchgear projects engineering division. **Mr. G. Cluley,** M.I.E.E., has relinquished executive responsibility for the latter division but will continue as consultant, Switchgear Engineering Department.

Mr. Dawson took his degree at Birmingham University, and joined M-V as a probationary college apprentice in 1934. From 1940 to 1945 he was seconded to the Admiralty as an experimental officer specialising in anti-magnetic devices. On completing his apprenticeship, which was interrupted by the war, he joined the Traction Control Engineering Department. In 1948 he transferred to the Traction Sales Department. He was appointed assistant sales manager, Switchgear Department, in March last year.

Mr. Stubbs was educated at Bristol University, and after a college apprenticeship and a period in the switchgear drawing office at Trafford Park he spent eight years with the M-V agents in Cairo, where he acted as the company's engineer on the North Delta pumping stations contract. In 1939 he joined the tendering section of the Switchgear Engineering Department. He was appointed assistant sales manager, Switchgear Department, in 1950 and has been sales manager since 1951. Mr. Stubbs has made many visits abroad, notably to Portugal and Spain, in connection with hydro-electric work; after the war he went to Germany as a member of a B.E.A.M.A. team for the study of German switchgear, and towards the end of 1950 he made a tour of Australia and New Zealand.

Mr. J. C. Dawson

Mr. J. E. Stubbs

Mr. A. J. Young, B.Sc., M.I.E.E., has been appointed general manager of the English Electric Valve Co., Ltd., in succession to Mr. S. M. Aisenstein who retired recently. When the English Electric Valve Co. was formed in 1947 Mr. Young became deputy general manager. Before this he was with Marconi's Wireless Telegraph Co., Ltd., which he joined in 1934. From 1936 to 1939 Mr. Young divided his activities between the Polish and Czechoslovak Marconi Companies. When Poland was invaded he returned to England and in 1941 he inaugurated the Marconi Wireless Telegraph valve laboratory at Great Baddow.

Mr. A. J. Young

On the advice of his doctors, **Sir Harry Railing,** chairman and joint managing director of the General Electric Co., Ltd., has undergone a minor operation. This has been entirely successful and he is making satisfactory progress.

Mr. R. D. Wellington has been appointed assistant to Mr. J. L. Thompson, general manager of Square D, Ltd. Mr. Wellington has transferred from the Square D Co. in Detroit, U.S.A., where he spent two years as administrative assistant to Mr. F. H. Roby, the vice-president in charge of sales.

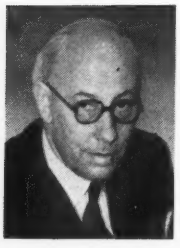
At the annual general meeting of the British Association for Commercial and Industrial Education (B.A.C.I.E.), held in London on 12th June, **Sir Godfrey H. Ince,** G.C.B., K.B.E., was elected president for 1956-57. Sir Godfrey is chairman of Cable & Wire-

less, Ltd. At the same meeting **Major-General C. Lloyd,** C.B., C.B.E., T.D. (Director of the City and Guilds of London Institute), was re-elected chairman of Council, and **Sir Ronald Nesbitt-Hawes,** C.B.E., E.D., M.I.E.E. (chief of educational administration, English Electric Co., Ltd.), was re-elected vice-chairman and hon. secretary. **Mr. F. Bray,** C.B., until recently Under-Secretary and head of the Further Education Branch, Ministry of Education, and **Mr. C. Williams,** lately managing director of Harris & Walford, Ltd., Redditch, have joined the advisory and training staff of B.A.C.I.E.

The Minister of Supply has approved a reorganisation of senior engineering posts and has made the following appointments:—

Sir Steuart Mitchell, K.B.E., C.B., M.I.Mech.E., at present Controller, Guided Weapons and Electronics, to be Controller, Royal Ordnance Factories, and also head of the Ministry of Supply engineering staff; **Mr. A. T. Barnard,** C.B., O.B.E., A.M.I.C.E., to be Director-General of Inspection (a new post); and **Mr. R. Ratcliffe,** M.B.E., M.I.Mech.E., to be Deputy Director-General of Ordnance Factories. The first two appointments will take effect on the 13th August and until that date Mr. Barnard, who has been acting Director-General of Ordnance Factories since the death of Mr. Kenneth Gordon, will continue so to act. Mr. Ratcliffe's appointment will take effect on the 25th June. The Royal Ordnance Factories which have previously been in the charge of a Director-General reporting to the Controller of Munitions will in future be under their own Controller. The new post of Director-General of Inspection has been created to manage and co-ordinate the various Inspectorates of the Ministry.

Mr. F. Mattingley, B.Sc.(Hons.), A.R.I.C., has been appointed general manager of Submarine Cables, Ltd. Born in 1900, he was educated at Chatham House School, Ramsgate, and at Birkbeck College, and joined the organisation in 1923 as an analytical chemist. During the past year he assumed technical control for the first transatlantic telephone cables which are being made at Ocean Works, Erith.



Mr. F. Mattingley

Mr. H. J. Gripper, B.Sc., M.I.E.E., M.(S.A.)I.E.E., who has been deputy to the city electrical engineer of Port Elizabeth, South Africa, for eight years, resigned from this position on 31st May and has opened his own office at 508-9, Alfin House, 130, Princes Street, Port Elizabeth, as an electrical and industrial consultant.

Mrs. Jean L. Stewart, formerly of the E.L.M.A. Lighting Service Bureau, has joined the staff of the lighting design service of Philips Electrical, Ltd. Mrs. Stewart has made a special study of home lighting and has lectured extensively on the subject. She was born in Sheffield and served an apprenticeship as an electrical engineer with the British Thomson-Houston Co., Ltd., at Rugby. She afterwards studied for four years at Sheffield University.

Mrs. J. L. Stewart.

Mr. F. L. Ingram (home sales manager) and **Mr. Alan G. Shaw** (works manager) have been elected to the board of Crypto, Ltd.

Mr. W. G. P. Fraser, C.A., has been appointed to the board of Mavor & Coulson, Ltd., with effect from 1st July next. Mr. Fraser joined the company in 1946, and since 1947 has been its accountant. He is also a director of the subsidiary company Mavor & Coulson (South Africa), Ltd.

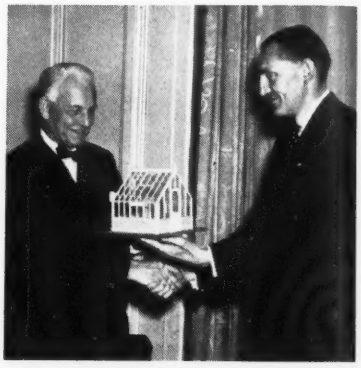
Seven coaches escorted by a fleet of cars were required for this year's annual works outing of **Dimplex, Ltd.,** which took place on Saturday last, when a visit was made to Weymouth. A full programme included morning coffee at Wimborne, lunch and high tea at the Dorothy Café, Weymouth, and the choice of a coach tour taking in Lulworth Cove or a trip round the warships in Portland Harbour during the afternoon. Mr. E. J. Wade, managing director, and Mr. H. R. Heath, director and secretary, congratulated Mr. W. Gardner and his organising committee on the excellent arrangements made.

At last week's luncheon of the **Electrical Industries Club** Sir Gilbert Rennie, K.C.M.G., was the guest-speaker. From his experience as a former Governor and Commander-in-Chief of Northern Rhodesia and as the present High Commissioner in the United Kingdom of the Federation of Rhodesia and Nyasaland, he dealt with the opportunities available in those territories for British electrical manufacturers. Next month's luncheon (10th July) will be "Ladies' Day."

In referring to the appointment of **Mr. E. S. E. Lee** as a director of Riley & Neate, Ltd., in our issue of 18th May, we incorrectly stated that he was a member of the I.E.E. Mr. Lee is in fact an associate member of the Institution of Civil Engineers.

At a luncheon held during Crompton Parkinson's branch managers' conference at the Charing Cross Hotel on 8th June a presentation was made to **Mr. T. H. Windibank,** on behalf of the sales staff of the company, to mark his retirement. Mr. Windibank, who had served Crompton Parkinson, Ltd., for thirty-three years, was appointed general sales manager of the company in 1927 on the amalgamation of Crompton & Co., Ltd., and F. & A. Parkinson, Ltd. He was a director of the company for seventeen years. His retirement took place on 31st March last.

Unable in such surroundings to present the gift itself (a cedar-wood greenhouse), Mr. J. B. Scott (sales director) handed to Mr. Windibank a scale model of the gift made by the exhibition section of the Publicity Department. Mr. Windibank also accepted two pieces of Poole pottery as mementos for his wife. Tributes to Mr. Windibank as the virtual founder



Mr. J. B. Scott (sales director, Crompton Parkinson Ltd.), making a presentation to Mr. T. H. Windibank (left) to mark Mr. Windibank's retirement

of the present-day Crompton Parkinson sales force were made by Mr. C. A. J. Martin, general sales manager, plant division, and Mr. C. J. W. Scott, general sales manager, supplies division. Mr. Windibank suitably replied.

Mr. Emrys T. Jones has been appointed area sales engineer for Pope's Electric Lamp Co., Ltd. His territory covers the West Country and South Wales. Mr. Jones was previously sales engineer with Mersey Cable Works, Ltd., and before that was with the South West Electricity Board and Christie Bros., Ltd.

OBITUARY

Mr. F. Carleton Anderson, M.I.E.E., a founder and past chairman of the Harland Engineering Co., Ltd., died at his home in Tunbridge Wells on 8th June. Mr. Carleton Anderson, who was eighty, was born in Glasgow and was educated in New Zealand and at the Royal Technical College, Glasgow. In the early part of his mechanical/electrical engineering career he spent some years on the staff of D. Selby

Bigge & Co., consulting electrical contractors. In 1903 he went into business on his own account with Mr. C. A. Atchley and the late Mr. Bowden to form the original partnership which became the Harland Engineering Co., Ltd.

Early contracts for the entire electrification of textile mills, steel works, coal mines, shipbuilding yards and paper mills were undertaken by Mr. Anderson and, although the initial emphasis was on electrical plant, mechanical contracts were also undertaken, including boiler plant. He was for a time sales director and then chairman of the company until 1943. After he retired from the board in 1952 he continued to take a keen interest in all activities of the company and especially in matters relating to the Harland "25 Year" Club. He was president of the Manchester Association of Engineers.

Mr. E. B. Wedmore.—We regret to report that Mr. Edmund Basil Wedmore, C.B.E., M.I.E.E., F.Inst.P., died on Saturday last at the age of eighty. Mr. Wedmore was director of the British Electrical and Allied Industries Research Association from its inception in 1921 until his retirement about twenty-four years later. He was born in Bristol and was educated at University College in that city. In 1895 he went into the Bristol Electricity Department but left there in the following year to join Professor Silvanus Thompson at Finsbury Technical College as lecturer and demonstrator. Four years later he became a design engineer with the British Thomson-Houston Co. and he remained with that company until 1919 when he was appointed technical officer to the Electrical Research Committee, the predecessor of the E.R.A., to become the director and secretary of the latter body in 1921.

Mr. Wedmore had served as a member of the I.E.E. Council and had been awarded a number of Institution premiums. He was the author of "Switchgear for Power Control," as well as two books on bee-keeping, on which he was an acknowledged expert.

Cremation is to take place at Golders Green to-day (Friday).

It will be recalled that Mr. Wedmore's successor, Dr. S. Whitehead, died last month.

Lady Dalton.—We report with great regret the death of Lady (Winifred) Dalton, the wife of Sir John Dalton, chairman of the Henley Organisation, which occurred at their home at Holmwood, Surrey, on Wednesday last week. Only a fortnight or so earlier Lady Dalton, whose husband was president, was a charming hostess at the British Electrical Power Convention at Torquay and so her death will have come as a great shock to the many electrical people who met her there. We extend our deepest sympathy to Sir John and their daughter, Mrs. Margaret Rimmer.

The late Lady Dalton

The funeral service took place at South Holmwood Church on Saturday last when many representatives of the Henley Organisation were present.

Manufacture of Miniature Valves

LAST week we had an opportunity of inspecting the modern factory at South Ruislip, of Hivac, Ltd., makers of miniature and sub-miniature valves, who completed the move into the new premises some months ago.

Cleanliness is the most important part of precision valve assembly and stringent precautions are taken to ensure it at every stage. The factory has been built with a barrel-vaulted roof to dispense with stanchions and roof girders, which represent potential dust collectors. Polished wood block floors are used and a slightly positive air pressure is maintained inside the factory, which is air conditioned throughout the assembly shop.

Although basically of single-storey construction, a capacious basement houses all electrical, gas, water and vacuum pumping accessories, so that fumes of any sort, pipes and wires are kept clear of the shops.

For particularly important items a part of the main assembly area has been partitioned off and here specially selected girl operators work at individually pressurised benches with glass screens to prevent moisture from normal breathing condensing on components during assembly; and individual pressurisation on each three-quarter covered bench ensures that no dust is attracted towards the work.

Even the company's smallest valves are assembled by hand, in carefully designed jigs, by the naked eye, without magnifying assistance. Life tests are carried out on a reasonable proportion of every batch produced and every valve made is subject to a rigorous testing. Check inspection is carried out by a separate department on a varying percentage of a production run, up to 100 per cent of the total, and where export orders are involved a complete re-inspection is carried out before despatch.

The company started as the High Vacuum Valve Co., Ltd., and now forms the Electronics Division of the Automatic Telephone & Electric Co., Ltd. Transistors, including Britain's smallest, miniature and sub-miniature valves, cold cathode tubes, neon indicators, switchboard lamps and now fluorescent indication lamps, represent the principal interests. Ample facilities exist adjacent to the new premises at South Ruislip for future extensions.

Left: Dexterity and a steady hand are required for this operation—the "mounting," or assembly, of a sub-miniature beam-tetrode amplifier valve. Right: Girls assembling special sub-miniature valves under pressurised benches in a separate area in the assembly shop

PARLIAMENTARY REPORT

MR. PALMER asked the Minister of Fuel and Power in the House of Commons last week what general directions he had given to the Central Electricity Authority, the Gas Council and the National Coal Board, on prices, wages and capital policy.

Mr. Aubrey Jones said he had given no directions. He did not think they were appropriate but everyone in these industries should be aware of the importance of steadiness of prices to the national economy and of the fact that wage increases unaccompanied by increased productivity must inevitably lead to higher prices.

Mr. Palmer asked if the rumours circulating in the Press and elsewhere that the Government were attempting to guide the nationalised industries were therefore without foundation.

Mr. Jones: "I would not say that such rumours had much foundation in the answer I gave, but surely as a result of the statements recently made by the Prime Minister and the Chancellor of the Exchequer it should be apparent to everyone that the country can ill afford wage increases that are not accompanied by increases in productivity."

Mr. Nabarro said the Chancellor of the Exchequer had referred recently to "a plateau of price stability." Did the Minister of Fuel and Power have regard to the highly inflationary action of increased coal prices?

Mr. Jones replied that the alternative would have been a still larger subsidy and subsidies were not, in the Chancellor's view, the way to cure inflation.

Cost of Nuclear Power

Mr. Warbey asked the Lord Privy Seal, what were the main components of the total cost of approximately 0.6d/kWh which the Atomic Energy Authority estimated to be the probable net cost of electricity generated by the early nuclear power stations and what was the selling price of the plutonium by-product assumed for the purpose of this estimate.

Mr. R. A. Butler said a paper presented at Geneva last August gave the detailed figures. Although some of the figures used in building up the estimate had altered in one way or another, it remained the best estimate that could be given.

Restrictive Trade Practices

In the committee debate on the Restrictive Trade Practices Bill, Mr. Walker-Smith, Parliamentary Secretary, Board of Trade, moved an amendment to Clause 6 (Excepted Agreements) to ensure that the Bill would not apply to any licence granted by the proprietor or any licensee of a patent, or to any agreements entered into by a person who had applied for a patent or the registration of a design. He said that the Clause as drafted excluded restrictive agreements arising from the grant of patent licences or the use of registered designs, but M.P.s would know that there was a certain inevitable time-lag between application for and the actual granting of a patent. The amendment was intended to exempt agreements which were entered into during this waiting period.

Sir Leslie Plummer wanted to know if the Clause would apply to patent pools, such as had been described in the Monopolies Commission's report on the supply of electric lamps. He referred to the "Phœbus agreement" which was designed to provide for an interchange of patents between the makers of electric lamps and said that out of this agreement had come the ordinary pool of patents. This pool was organised solely for exchanging patents between companies who formed themselves into an association (the E.L.M.A.) *inter alia* for the purpose of fixing prices, restricting output, sharing markets and excluding from access to the patents firms who were not members of the Association. He was sure the Government did not want to perpetuate a combination which was very properly attacked by the Monopolies Commission. The Government should say whether the Clause gave an opportunity for the re-creation of patent pools.

Sir Lionel Heald, a former Attorney-General, said the Phœbus agreement was international and had special characteristics. It was shown clearly to the Commission, and this was made clear in the report, that the result of the agreement had been to build up a great British industry.

Mr. Walker-Smith said that the exempted patent licences or agreements would still come within the safeguards of the Patents Act. The purpose of the Clause was to avoid a duality of control. Where articles were made by a patented machine they now came within the exemption and were covered by the same safeguards in Sections 37 and 38 of the Patents Act. He could not deal with pooled patents because they were not affected by the amendment. As he understood it, an agreement to pool patents *simpliciter* would not itself be registrable because it was not a restriction relating to goods. Therefore it was outside Clause 5 of the Bill, but an agreement between holders of patents as to the terms on which each would license people to use his patent was registrable under the Bill.

Mr. Douglas Jay asked what was the position if there was a normal patent agreement between certain parties relating to certain goods, and these parties made another agreement of a restrictive kind wholly unconnected with the patent, relating to the same goods. Would that be registrable as the Bill was now drafted?

Mr. Walker-Smith said it would be. The amendment was agreed to.

An amendment, implementing the Government's promise to exclude from the Bill agreements simply relating to "know how," was agreed to as also were amendments excluding from the operation of the Bill agreements made in relation to trade marks. Approval was also given to an amendment stating: "No account shall be taken for the purposes of this part of this Act of any agreement to comply with or apply, in respect of the production of any goods or the application to goods of any process of manufacture, standards of dimensions, design or quality for the time being approved by the British Standards Institution."

Financing Nationalised Industries

During an all-night debate on the Finance Bill, Viscount Hinchingbrooke and other Conservative members sharply criticised Clause 34 which provides that the nationalised industries will be able to obtain their capital by way of Exchequer advances—not to exceed £700 million—in the next two years, instead of borrowing on the money market.

Viscount Hinchingbrooke said there were two major errors in the Clause: it invited the same treatment for all the other nationalised industries as was now given for coal; and it brought these industries more and more under the aegis of the State, establishing a procedure which it would be very difficult to reverse. Ideas such as were incorporated in the Herbert Report for separate borrowing by the Electricity Boards would be rendered almost impossible of attainment. Local authorities had wisely been pushed on to the market from beneath the umbrella of the State for their money needs. Why the difference between them and the nationalised industries?

Labour M.P.s supported the Government's proposal. Their principal spokesman, Mr. Harold Wilson, said that the idea that the House could continually discuss in detail the actual investment policy of every nationalised industry and criticise it did not tie in with the demand that Ministers should divest themselves of responsibility for the investment programmes.

Mr. Nabarro declared that if the whole of the £200 million a year capital investment in the electricity industry were spent legitimately for generating, distributing and selling electricity, he would view it with more favour, but it was not. Large sums were for the working capital of the Area Boards' purely commercial operations—selling refrigerators, television and radio sets and competing with private firms for electrical contracting work. Highly subsidised finance for the nationalised

industries was grossly unfair to private enterprise. The Herbert Committee's recommendation was that the Area Electricity Boards should compete for capital funds on the market without the support of a Treasury guarantee. "If that were done, there would be little need for Parliamentary accountability," Mr. Nabarro concluded.

Mr. Harold Macmillan, Chancellor of the Exchequer, asked the House to accept the view that since the Exchequer had in present circumstances to bear the burden of providing at least the bulk of the capital finances of these industries it was better, in the wider interests of the management of Government credit and funding Government debt, that the Exchequer should be in charge of the whole operation. Of course, the Government would like to move in the direction of the Herbert Committee's report; it would be a good thing, but he did not think it was practicable. The rate of interest on the Exchequer advances would correspond broadly to those appropriate to Government credit for a comparable period of years. At present the rate for similar Exchequer advances was 5 per cent for loans of over 15 years. The exact terms were still being discussed. It seemed likely that periods of between 25 and 40 years would be fixed in most cases.

The Clause was agreed to.

Investment Allowances

Earlier, Mr. Roy Jenkins sought to amend Clause 12 (which suspends investment allowances, with certain exceptions) to provide that capital expenditure up to £5,000 should continue to rank for the allowance. He said his amendment was designed to assist small businesses on which the credit squeeze pressed most heavily, making it difficult for them to expand.

Replying for the Government, Sir Edward Boyle, Economic Secretary to the Treasury, said that while it was true that the Government were suspending investment allowances, they were restoring initial allowances and in conditions more favourable to small businesses than in 1951 when they were last given.

The amendment was negatived by 257 votes to 199.

Mr. C. R. Hobson moved an amendment to retain investment allowances for the machine tool industry. He said that British machine tool firms, especially the small family concerns, needed more investment for modernisation in order to meet the keen competition from firms in the U.S.A., Switzerland and Western Germany.

Mr. Cyril Bence said that he had helped to install German automatic processes in the Midlands. These could have been made in Britain but for the fact that our machine tool industry had become quite out of date, lagging behind the new developments in technology. It would go downhill fast unless it produced machine tools which could be linked up into a chain of production processes.

For the Government, Sir Edward Boyle said it was disturbing that £4 million worth of machine tools were imported in the first two months of this year, and the Chancellor of the Exchequer had given serious consideration to this amendment. But he had come to the conclusion that he could preserve the investment allowances only for shipping, scientific research and fuel-saving plant.

The amendment was negatived by 253 votes to 195.

Mrs. Slater moved an amendment to add to the plant installed in the interests of fuel economy (which will rank for investment allowances) "plant for the prevention of atmospheric pollution."

Sir Edward Boyle said the aim of keeping the investment allowance for fuel-saving plant was to save coal. The case for clean air, however, rested on quite distinct grounds. A concession in favour of clean air plant, as such, would introduce a new class of excepted assets, prescribed not in the interests of fuel-saving but of health and amenity.

The amendment was defeated by 223 votes to 167.

Mr. Albu moved an amendment to retain the investment allowance in industries where the Government considered it would increase exports, save imports, and promote the better use of national resources. He said that the steel industry's expansion plans were not sufficient to match the rate of growth of the engineering needs of the country for the next few years, and investment in it should be stimulated. It might be advisable to stimulate the manufacture of electrical generating plant for which, in the future, there would obviously be an increasing export potential.

For the Government, Sir Edward Boyle said he did not think Parliament would be well advised to adopt this idea of a discriminatory subsidy to industry. It would be wrong to use the taxation system as a means of encouraging one type of investment rather than another.

The amendment was negatived by 210 votes to 146.

Copper Stocks

In reply to Mr. E. Johnson, the President of the Board of Trade (Mr. Thorneycroft) said that approximately 114,000 tons of copper had been sold by his Department since 1st January, 1954. This included sales by the Ministry of Materials. He had no information about the proportion of the metal exported.

The copper stocks now held by his Department, apart from a small trading residue of 1,700 tons, were held in the strategic reserve and it would be contrary to well established practice to give any information about the size of this stock.

Radiation and Health

Commenting on the report of the Medical Research Council Committee into the effects of nuclear radiation, the Prime Minister, Sir Anthony Eden, said it dealt with complicated matters which would require careful study by all concerned. The Committee's findings about radiation from such sources as the diagnostic use of X-rays would require much detailed consideration with the appropriate scientific, medical and industrial bodies. To the extent that Government Departments were concerned, he was arranging for the necessary studies to be made as soon as possible.

Catalogues and Lists

CABINETS.—Folder containing three catalogues of the "Widney Dorlec" range of cabinets and telescopic mountings for telecommunications, electronic equipment and instrumentation panels.—**Hallam, Sleigh & Cheston, Ltd.**, Oldfield Road, Maidenhead, Berks.

CABLES.—Leaflet on the company's railway signal control cables.—**Telegraph Construction & Maintenance Co., Ltd.**, Telcon Works, Greenwich, London, S.E.10.

DUCT FORMER.—Leaflet describing the company's lightweight metal cable sheath specially designed for forming ducts in prestressed concrete.—**Ductube Co., Ltd.**, 1, Adelaide Street, Strand, London, W.C.2.

ELECTRIC MOTORS.—Folder giving particulars of the "Merlin" lightweight f.h.p. motors designed for light industrial requirements and for use in washing machines and other domestic appliances.—**Brook Motors, Ltd.**, Empress Works, Huddersfield.

Brochure dealing with small motors and generators produced by the company.—**Westool, Ltd.**, St. Helen's, Auckland, Co. Durham.

FANS.—Illustrated 40-page catalogue (2206) of fans, blowers and exhausters.—**Sturtevant Engineering Co., Ltd.**, Southern House, Cannon Street, London, E.C.4.

GOGGLES.—Illustrated catalogue (156) of protective safety goggles including welding goggles and shields.—**J. & R. Fleming, Ltd.**, P.O. Box 110, 146, Clerkenwell Road, London, E.C.1.

LIGHTING FITTINGS.—Illustrated 26-page priced catalogue (63) dealing with the company's range of lighting fittings and lampshades in modern and contemporary styles.—**Knightshades, Ltd.**, Silverhill Works, Theaklen Drive, St. Leonards-on-Sea, Sussex.

68-page handbook covering fluorescent and tungsten lighting fittings, together with price list insert.—**Crompton Parkinson, Ltd.**, Crompton House, Aldwych, London, W.C.2.

PHOTO-ELECTRIC EQUIPMENT.—Eight-page catalogue describing photo-electric equipment manufactured by the company for such purposes as high-speed counting, smoke detection, burglar alarms and other applications.—**Londex, Ltd.**, 207, Anerley Road, London, S.E.20.

PUMPS.—Fifteen-page illustrated descriptive catalogue dealing with a range of motor-driven coolant pumps for use on machine tools.—**Engines & Electrics, Ltd.**, 48, Princes Gate, London, S.W.7.

SWITCHGEAR.—Catalogue (SG/332) and a leaflet (SG/334) describing the company's class "E" switchgear.—**English Electric Co., Ltd.**, Stafford.

Financial Section

STOCKS and SHARES

SO far as public interest in stocks and shares is concerned, the Trinidad Oil deal has been meeting with little competition lately from other sections of the Stock Exchange. Present lack of animation there suggests that investors have accepted this time the advice of the old City maxim to "sell in May, and go away." At least, however, the selling seemed to have largely spent itself by the middle of this month, so that it requires only a very moderate volume of new investment to keep prices steady. In the gilt-edged market the rally petered out, and quotations slipped back a little. Industrial markets, while generally very quiet, have been by no means lacking in incident, connected mainly with individual company news. With offers outstanding for the shares of McMichael and Revo Electric, the electrical equipment market has shown that "take-over" propositions are not a monopoly of the oil department.

Price Changes

A.E.I. reached the 70s mark again in repeating the previous week's gain of 1s 3d. The new shares are now 40s paid up, with the final call of 17s 6d due by 15th August, and stand at an all-in price of 68s 9d (free of stamp). English Electric and G.E.C. advanced in step to the common level of 55s. Reliance Clifton Cables 5s shares were raised to 11s 9d after news of the increases in profits and dividend. The latter is brought up to a total equivalent to 13½ per cent (covered four times by earnings) and produces a yield of 5¾ per cent on the shares. British Aluminiums rose in active dealings by a further 6s to nearly 60s before reacting to 57s; the new shares were about 58s. Among other improvements, W. T. Henley's were noticeably firm after the annual meeting, and useful gains were recorded in Lucas, London Electric Wire and Marryat & Scott.

De La Rue Results

Thomas De La Rue 5s shares were a fraction easier, at 18s 9d, after the declaration of the final dividend, which brings the total for the year to 30 per cent, as before. The net profit of £319,000 (after a larger tax charge) represents an advance of 11 per cent on the previous year's surplus, and provides practically twofold cover for the net amount of the ordinary distribution. At last year's meeting the chairman was of the opinion that the development of the business might be reaching a point when further finance would be required. No further reference has been made to this matter, but meanwhile the company's preliminary statement of the results discloses that £100,000 of the past year's profit is being taken to the general reserve which, with other appropriations, will now be raised to £1.3 million. The yield on the shares is 8 per cent.

Good Results

Improvements of 9d each in the ordinary shares of Ward & Goldstone

Price Changes in

Company or Board	Nom. Value	Middle price 18th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	75½		3	3	3 19 6	80½	75
Brit. Elec. 1974/77	100	74½			3	4 0 6	79½	73⅜
Brit. Elec. 1976/79	100	78½		3½	3½	4 9 3	84	78½
Brit. Elec. 1974/79	100	89½		4¼	4½	4 15 0	95	88
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6†	6†	6 3 0†	20/9	19/-
East African Power	£1	19/-	—6d	7	7	7 7 3	21/3	19/6
Nigerian Elec.	£1	19/6	—6d	10	10	10 5 0	21/-	17/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	Nil	21/-	21/-
Perak Hydro-Elec.	£1	15/6	—6d	10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	11/3	+3d	17½	17½	7 15 6	13/6	10/6
Aerialite	1/-	5/-		88½	45*	9 0 0	6/9	5/-
Allen, W. H.	£1	37/6		20	10*	5 6 8	39/-	33/6
Aron Elec. Ord.	£1	56/-		15	15	5 7 3	56/-	53/6
Assd. Automation	10/-	17/-	—1/-	10	5	2 18 9	—	17/-
Assoc. Elec. Ord.	£1	70/-	+1/3	14	15	4 5 9	85/6	57/9
Automatic Tel. & El.	£1	56/3		15	15	5 6 9	72/6	56/3
Babcock & Wilcox	£1	76/-	+6d	15	15	3 19 0	85/6	64/-
Baldwin, H.	2/-	4/9		20	20	8 8 6	5/-	3/9
Bakelite	10/-	28/6		16	16	5 12 3	34/-	26/9
Berry's Electric	5/-	6/6	—	—	10‡	7 13 9	6/6	5/9
British Aluminium	£1	57/-	+3/3	12	12	4 4 3	60/-	40/6
B.I. Callender's	£1	51/6		10	12½	4 17 0	54/3	45/-
B.I. Callender's 6% Pref.... ...	£1	21/-		6	6	5 14 3	22/6	20/3
British Thermostat	5/-	26/3		20	25	4 15 3	31/9	24/6
British Vac. Cleaner	5/-	6/6		30	15*	11 10 9	8/9	6/9
Brook Motors	10/-	36/3	—1/6	20	25	6 18 0	44/-	36/3
Brush Ord.	5/-	6/3		10	10	8 0 0	7/9	6/3
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/9	—9d	—	22½	12 17 3	13/3	8/6
Chloride El. Storage "A" ...	£1	62/6	+6d	17½	17½	5 12 0	73/6	60/9
Clarke Chapman	£1	107/6		20	22½	4 3 9	112/6	89/6
Cole, E. K.	5/-	16/-		27½	17½*	5 9 6	22/3	15/6
Cossor, A. C.	5/-	7/-		10	15	10 14 3	10/3	6/9
Crabtree	10/-	28/-		20	20	7 2 9	29/3	27/-
Crompton Parkinson Ord. ...	5/-	13/9		20	16*	5 16 3	15/-	12/3
De La Rue	5/-	18/9	—1/-	30	30	8 0 0	20/3	15/-
Decca	4/-	28/3		56½	43⅜*	6 4 0	44/9	24/9
Desoutter	5/-	27/3		25	30	5 10 0	32/9	25/9
Dewhurst	2/-	7/3	—3d	24	30	—	7/6	5/3
Dictograph Tel.	2/-	6/-		20	20	6 13 3	6/9	6/-
Dubilier Condenser	1/-	3/9	+3d	25	25*	6 13 3	4/6	3/6
E.M.I.	10/-	26/9	+3d	10	15	5 12 3	37/-	26/3
Electrical Components	5/-	12/6		20	25	10 0 0	16/-	12/6
Elec. Construction	£1	27/6		15	8½	6 3 9	29/9	25/-
Enfield Cable Ord.	£1	15/-		Nil	Nil	Nil	19/3	14/-
English Electric	£1	55/-	+1/9	12½	12½	4 11 0	66/3	47/3
English Electric 3¾% Pref. ...	£1	13/6		3¾	3¾	5 11 0	14/6	12/6
Ericsson Tel.	5/-	36/6		20†	20†	2 14 9†	42/9	33/6
Ever Ready	5/-	26/6	—6d	35	35	6 12 0	32/9	24/-
Falk Stadelmann	£1	37/6		15	17½	9 6 9	45/9	37/6
G.E.C. Ord.	£1	55/-	+1/9	12½	14	5 1 9	65/6	50/-
G.E.C. 6½% Pref.	£1	23/3		6½	6½	5 11 9	23/9	21/3
General Cables	5/-	12/3		30	30	12 5 0	13/9	12/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Cable	5/-	22/3		20	25	5 12 3	24/6	18/9
Hackbridge & Hewittic	5/-	18/9	—6d	25	30	—	22/-	17/3
Heatrae	2/-	4/9		15	15	6 6 3	5/1	4/9
Henley's	10/-	17/3	+1/-	10½	11½	6 13 3	19/9	14/-
Holophane	5/-	18/9		25	30	8 0 0	19/-	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
*After scrip issue. †Free of income tax. ‡Dividend forecast.

and Walsall Conduits registered satisfaction with the annual results. For the 12 months ended in March, Ward & Goldstone report a 20 per cent expansion in the group trading profit. A much increased tax charge leaves the net surplus of £343,000 only a little above the previous figure, but the company are able to raise the ordinary dividend from 30 to a total of 35 per cent without distributing much more than one-fifth of the year's earnings. A yield of barely 5 per cent on the shares at 36s gives credit for this wide margin between earnings and dividends, and for the fact that they have done consistently well for holders over a long period.

Electrical Investments

Company or Board	Nom. Value	Middle price 18th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	26/3		70	50	9 10 6	39/3	23/-
I.C.I.	£1	44/6	+3d	10	10	4 10 0	49/9	41/3
Intl. Combustion	5/-	20/-		25	20*	5 0 0	25/-	15/3
Johnson & Phillips	£1	41/3	+6d	15	15	7 5 6	46/6	37/6
Lancashire Dynamo	£1	43/9		15	11*	5 0 6	49/9	40/9
Laurence, Scott	5/-	15/6	+3d	12½	15	4 16 9	16/9	13/3
Lister, R. A.	£1	32/6		9.3	10	6 3 0	35/3	27/6
London Elec. Wire	£1	51/3	+1/3	12½	12½	4 17 6	52/9	46/5
Lucas, J.	£1	32/6	+1/3	7½	7½	4 12 3	40/3	30/-
Marryat & Scott	2/-	11/-	+3d	25	30	5 9 0	11/-	9/6
Mather & Platt	£1	52/6	—6d	13.4*	15	5 14 3	65/3	51/6
Metal Industries	£1	20/-		9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	47/6		10	12½	5 5 3	48/6	43/6
Morphy-Richards	4/-	20/-		35	50	10 0 0	27/3	20/-
Murex	£1	68/3		15	20	5 17 3	70/3	60/-
Newman Ind.	2/-	2/6		10	10	8 0 0	2/9	2/1
Oldham & Son	1/-	2/6		17½	20	—	3/-	2/4
Parnall (Yate)	5/-	6/6		14	12	9 4 6	9/6	5/6
Parsons, C. A.	£1	85/-	+2/6	10	10	2 7 0	85/-	61/6
Plessey	10/-	67/6	+6d	27½	30‡	4 9 0	87/6	56/-
Pye "A" Deferred	5/-	16/3	—6d	20	12½*	3 17 0	21/3	14/-
Revo	10/-	13/6	+2/-	9	9	6 13 3	13/6	8/3
Reyrolle	£1	105/-	+2/6	15	16½	3 2 0	110/-	81/-
Rheostatic	4/-	9/-		18½	12‡	5 6 9	—	8/3
Richardsons Westgarth	5/-	16/-		16¾	16¾	5 4 3	17/-	13/9
Scottish Cables	4/-	16/3		27½	27½	6 15 3	17/9	15/9
Smith (England), S.	4/-	11/6		17½	17½	6 1 9	14/3	11/-
Southern Areas	£1	20/-		10	7½	7 10 0	28/9	20/-
Strand Elec.	5/-	7/9		17½	15*	9 13 6	8/6	7/3
Sturtevant	5/-	23/-	—9d	14.4†	15†	3 5 3†	31/3	23/-
Sun Elec.	£1	35/-	—1/-	15	20	11 8 9	37/6	35/-
Switchgear & Cowans	5/-	13/6		20	25	9 5 3	17/-	13/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	14/-	11/3
T.C.C.	10/-	43/3		25	25	5 15 6	45/-	40/6
T.C. & M.	£1	29/-		8½	8½	5 17 3	34/-	26/-
Telephone Mfg.	5/-	7/6		10	10*	6 13 3	8/6	6/3
Thorn Elec.	5/-	17/6		20	15*	4 5 9	22/6	16/-
Thornycroft	£1	43/9		15	15*	6 17 3	49/9	41/3
Tube Investments	£1	58/9	—2/6	22½	14*‡	4 15 3	70/6	54/9
Vactric	5/-	13/9		15	17½*	6 7 3	15/-	11/6
Veritys	5/-	8/3		12½	12½	7 11 6	10/-	6/9
Walsall Conduits	4/-	13/3	+9d	70	20*	6 0 9	13/6	10/9
Ward & Goldstone	5/-	35/9	+9d	30	35	4 18 0	38/3	29/-
Watford	2/-	6/6		25	25	7 13 9	7/6	6/6
Westinghouse Brake	£1	76/3		18	18	4 14 6	100/-	71/6
West, Allen	5/-	13/-	+3d	15	15	5 15 6	14/6	11/6
Wolf Electric	5/-	19/-		20	20	5 5 3	26/3	19/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A. Ord.	100	75		6	6	8 0 0	80	66
Ord.	100	49½	—½	3¾	3¾	7 11 6	54	45
Anglo-Portuguese	£1	23/-		8	8	6 19 3	23/6	20/3
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	18/6	+6d	50	22½*	6 1 6	20/-	15/6
Cable & Wireless:								
Ord.	5/-	10/6		10	10	4 15 3	11/3	9/6
4% Loan	100	91		4	4	4 8 0	92½	88
Calcutta Trams	£1	25/-	+2/-	6†	7½†	6 0 0†	26/3	23/-
Cape Elec. Trams	£1	18/3		5½	7½	8 4 6	20/3	18/-
Marconi Marine	£1	31/6		10	10	6 7 0	34/-	31/-
Oriental Tel. Ord.	1/-	71/3	—1/3	16	—	—	90/-	71/3
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/9	9/9

Walsall Conduits

Dividends for 1955 from Walsall Conduits go to ordinary capital increased to £800,000 by the three-for-one scrip issue of eleven months ago. Allowing for the latter, the final dividend now declared represents in effect an increase in the total by 2½ to 20 per cent, for the year. This is provided for comfortably by the advance in the net profit (despite larger taxation) from £215,000 to £256,000, which exceeds by more than two-and-a-half times the amount of the ordinary distribution. The last increase in the dividend was on account of 1952, and was also the sequel to a scrip issue. Having been marked up to 13s 3d the 4s shares show a yield of just over 6 per cent from the new rate of dividend.

Offer for Revo

Revo Electric 10s shares were marked up sharply upon news of the coming offer of an exchange into the Duport Company's 5s ordinary shares, in the proportion of three of the latter for four Revo shares. With the Duport shares quoted at 19s 3d at the time of the announcement, the corresponding value of Revo shares worked out at 14s 5d; they had been standing around 11s 6d a week previously, and moved up subsequently to 13s 6d. As regards dividends, present Revo shareholders would retain the 5½ per cent final dividend now declared for 1955-56, and an interim of 3 per cent on account of the current year, while the Duport shares issued in exchange would not participate in the 20 per cent final dividend (making a total of 25 per cent) expected to be paid by that company for 1955-56. The offer will be subject to acceptance by a minimum percentage of Revo shareholders. Meanwhile Revo an nounce a modest improvement in the net profit for the past year.

Ultra Electric

The 5s shares of Ultra Electric were called 10s 3d after the declaration of a 15 per cent dividend for 1955-56, on which basis the yield works out at 7.3 per cent. Owing to delays in the completion of the accounts, the declaration is made without the accompaniment of the usual preliminary profits statement, but shareholders are meanwhile given a general review of the position. Difficult trading conditions during the year reduced sales of radio and television sets below estimates. Turnover showed a reasonable improvement to reach another record level, but profit margins were smaller and the results will not be up to the previous figures. The directors are satisfied, however, that they will cover satisfactorily the dividend now declared, and are active in switching production over to the group's special products, for which there is a large order book.

REPORTS AND DIVIDENDS

W. T. Henley's Telegraph Works Co., Ltd.—The annual meeting was held on 14th June, Sir John Dalton (chairman) presiding. In the course of his speech, Sir John said that business in 1955 reached an all-time record and a great factor in their success was the very much larger turnover, exceeding by some millions the figure attained in any previous year. They had again had to face considerable fluctuations in the prices of their principal raw materials, copper and rubber, and the high price of copper had led to some increase in the demand for aluminium for conductors and for overhead transmission line conductors.

The contract organisation had had a successful year, and here again the value of work carried out was an all-time record. Notable contracts completed or for which orders were received during the year included part of the 275 kV overhead transmission system for the national grid, their contract being for the heavy conductor line between Staythorpe and Drakelow. The 132 kV 3-core oil-filled cable ordered by the N.W. Merseyside and North Wales Division, C.E.A., was now in course of installation, and later in the year an order was received for a similar cable for the C.E.A. Midlands Division for the Nechells power station. Another contract to a value of £250,000 was received from the Steel Co. of Wales for their new works at Velindre. Among overseas contracts was one from the Calcutta Electric Supply Corporation worth £238,000 for 25 miles of single- and double-circuit 33 kV steel tower line. The Contract Department in South Africa had another successful year, while the Contract Department set up in Australia three years ago was making good progress. The sales of their Engineering Department exceeded all previous records and their engineering shops were loaded to capacity. Several new products were put on the market during the year and other new ones were in course of development.

With regard to exports, their intake of export trade increased by 70 per cent as compared with 1954. Some important orders were received for telephone cables and a few weeks ago they received a further order from Bogota to the value of one million dollars for telephone cables. They were also sharing in a contract recently concluded with the authorities in Iran for the supply of telephone cables, the total value of which might well come to some £2,000,000, spread over several companies in this country. The Fairfield cable factory, in Australia, in which they were jointly interested with two other cable companies, had made considerable progress, and by the autumn power cables were being manufactured. Equipment had also been installed for the production of fully impregnated non-draining cables and much of the plant required for the production of winding wires had also been installed and already some of the larger sizes of wire were being produced.

The Development and Research Departments had undertaken a very considerable programme of investigation and study of design.

Referring to the subsidiary companies, Sir John said that the total demand on the factory of the Henley Tyre Co. had been greater than its capacity. Oakley Brothers, Ltd., had also had a successful year and in the case of Henley's (South Africa) Telegraph Works Co., Ltd., there were increased sales of cables and other goods.

They had begun the current year with a fairly substantial order book and the total value of orders received to date had been well maintained. There were certain economic trends, however, which might adversely affect prospects. The Government's decision to restrict capital investment in some of the nationalised industries, particularly by the C.E.A. and the Area Boards, might result in a contraction in the demand for power cables, and the official monetary policy might lead to curtailment of industrial activity, especially in those industries concerned primarily with the home market. On the other hand, these adverse influences might be mitigated to some extent by the Government's programme of main line electrification and its plans for the extended electrification of the collieries. With regard to export business, while they anticipated being able to maintain a satisfactory volume of overseas sales, former traditional markets were rapidly becoming self-sufficient, and they were therefore having to redouble their efforts to seek compensating markets elsewhere. Last year they succeeded in obtaining business from no fewer than 82 countries.

The Southern Areas Electric Corporation, Ltd.—In his address to shareholders at the annual meeting held on 14th June, Lord Gridley (chairman) said that the smaller profits for 1955 were due to a number of factors. There was a decrease in the volume of orders and output of the largest subsidiary. After some falling off in orders for Government Services and from some regular customers, including marine, the volume secured in more recent months had shown a welcome improvement. The sale of some of their products, for example, space and water heaters and electrical accessories, had been adversely affected by the increase in the purchase tax and/or restrictions on hire purchase. Production costs in wages and materials had also increased and their railway signal manufacturing subsidiary had not yet secured the volume of business which it had been hoped would have been placed before now. There were signs that the current year might be a more favourable one than 1955 had been. Lord Gridley referred to extensions of the Corporation's factories at Chalford and Merrow and the reconstruction of the Mawdsley factory.

Ward & Goldstone, Ltd.—The group trading profit for the year to 31st March last was £900,837, as compared with £751,194 for the previous year, and after meeting all charges, including £355,683 for taxation, the net profit is £343,475, an increase of £16,372. General reserve receives £500,000 and it is proposed to pay a final ordinary dividend of 22½ per cent (against 20 per cent), making 35 per cent for the year (30 per cent).

Walsall Conduits, Ltd., reports group profits for 1955 of £537,454, as compared with £449,344 for 1954, and after deducting taxation of £281,805 the net profit is £255,649 (against £215,241). General reserve receives £20,000 and it is proposed to pay a final ordinary dividend of 12½ per cent, making 20 per cent for the year. This compares with a total distribution for 1954 of 70 per cent paid on capital of £200,000 before a three-for-one scrip issue. The balance carried forward is £541,334 (against £663,372 brought in).

Ultra Electric (Holdings), Ltd., has declared a dividend of 15 per cent for the year to 31st March last on capital of £725,000 as increased by a one-for-six scrip issue. A similar distribution was made for the previous year on the smaller capital. It has not been possible to complete the year's accounts at the usual time because some large contracts are in process of price adjustment and these have an important bearing on the results for the year.

Burco Dean, Ltd., has declared an interim dividend of 5 per cent (against 7½ per cent).

Revo Electric, Co., Ltd.—Duport, Ltd. (formerly Vono Industrial Products) is to make a share exchange offer for the £1,102,500 one-class capital of the Revo Electric Co., Ltd., on the basis of three ordinary 5s shares in Duport for every four ordinary 10s shares in Revo. Shareholders of Revo will be entitled to the 1955-56 final dividend and to an interim of 3 per cent for 1956-57, which it is intended to declare on 30th July. Duport shares to be issued in exchange would not participate in that company's final dividend for the year to 31st July next, which, as will be indicated in the offer, is intended to be 20 per cent, making 25 per cent (23 per cent for the previous eleven months).

The net profit of the Revo Electric Co., Ltd., for the year to 31st March last, is £97,349 (£89,297), after providing £131,216 for taxation. The final dividend is 5½ per cent, maintaining the year's distribution at 9 per cent.

The General Cable Manufacturing Co., Ltd., has declared an interim dividend of 12 per cent (unchanged).

Metal Strip Handling

Use of Special Pallets at G.E.C. Telephone Works

OF the big-scale handling problems remaining in industry for which there is no text-book solution, those raised by large stocks of metal strip or sheet are among the most difficult. They occur often—particularly as far as strip is concerned—where volume and variety of production demand rapid turnover and a closely controlled issuing system. These handling problems have been met in a variety of ways, though not always to the entire satisfaction of works managements.

The introduction of the fork truck opened new possibilities for strip users, though it offered no automatic solution. The variety of weights and sizes in which strip deliveries arrived, and the absence of a ready made entry for the forks, were the immediate drawbacks.

At the Telephone Works of the General Electric Co., Ltd., at Coventry, a strip handling system turning over as much as 100 tons a day in numerous sizes has been put into successful operation with the aid of standard Lansing Bagnall pedestrian-controlled fork trucks. The character of work at Coventry is essentially light engineering. Parts and assemblies are produced for telephone exchanges, telephone instruments, radio and television, involving a great variety of metal pressings, mainly in steel. The only mechanised operation in the whole sequence used to be the removal of the bulk delivery from lorries in the receiving bay—performed by an overhead travelling crane—though even this consisted only of lifting the material down to ground level.

From that position it was manhandled, often piece by piece, on to flat trucks, pushed into the stores and weighed. High wooden racks were used for storage, and again the strip or sheet had to be manhandled into the correct pigeon hole. Step ladders were the only means of reaching the highest racks. When material was needed storemen went to the appropriate rack and repeated the manhandling process, trundling the flat truck into the press shop and unloading it at the machines.

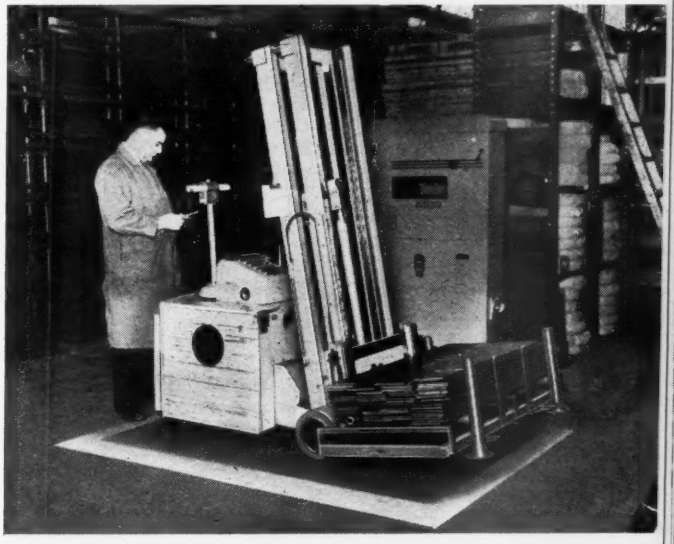
Economy in Manpower and Space

Numbers of men were needed for this work, and the wooden racks took up a great deal of space. Increasing production demanded that more materials be stocked. Under the old system there was no room to absorb the increase and after consultation it was decided to reorganise the stores for fork truck handling, and the first of two Lansing Bagnall PF20/15/T trucks was delivered in late 1952. These are capable of lifting loads of one ton to a height of 10ft 10in, and are particularly suited to store work because of a fumeless and almost noiseless drive.

Coinciding with the arrival of the first truck, the G.E.C. took delivery of the first batch of specially designed pallets to replace the wooden racks. There are now 1,000 of these pallets, designed for the strip and small sheet store requirements. Basically they are welded tubular post pallets holding maximum loads 54in long by 32in wide, but they are made with crossbars giving two levels of entry for the truck's forks. This "take it or leave it" design enables the truck driver to lift either the pallet together with its load or, by using the upper fork entry, the load alone, leaving the pallet undisturbed. Suppliers were approached to make strip deliveries in bundles of not more than one ton.

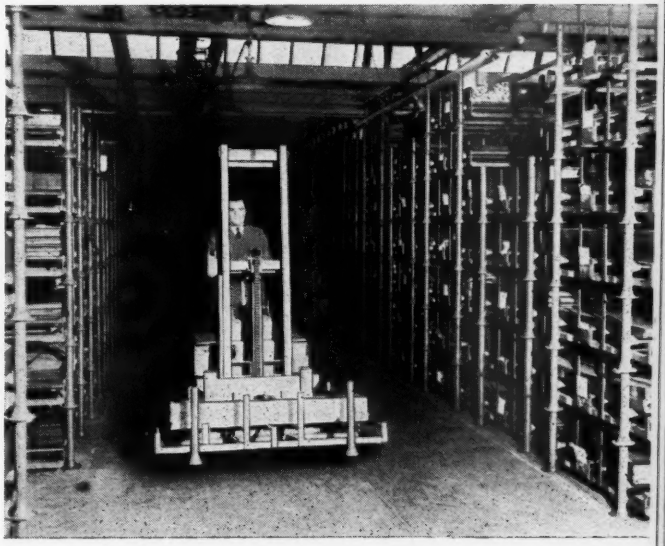
Bundles are seldom split, and in general the Lansing Bagnall truck takes the whole pallet load to a machine and leaves it ready for use. So that no return of materials is necessary, batch sizes on the machine loadings are arranged to use quantities of materials as nearly as possible in multiples of ½ ton. From the issue of materials the production of the required quantities of piece parts is determined, and the convenience of the "take it or leave it" pallet system assists greatly in the issue of accurate amounts. Sizes of metal frequently needed less than a ton at a time are ordered in smaller bundles to avoid the necessity for splitting or making up.

A considerable amount of space was saved, enabling the stores to meet the works demand for greater output from the same floor space. Operating cost of the truck is low, for it will run for a whole shift without recharging. The storeman going off duty leaves his truck plugged into the a.c. mains supply, as a charger with automatic cut-out is built into the Lansing Bagnall design.



The battery electric truck is driven direct on to an Avery scale to check weights

Pallet movement in the stores area



Expansion in Southern Rhodesia

ELECTRICITY SUPPLY COMMISSION'S ANNUAL REPORT

THE nineteenth annual report of the Electricity Supply Commission of Southern Rhodesia covers the period 1st July, 1954, to 30th June, 1955, whereas the eighteenth report covered the twelve months ended 31st March, 1954. This change brings the Commission's year into line with that of the Federal Government of Rhodesia and Nyasaland.

One consequence of the change in year is that the winter load is now divided, unequally, over two accounting periods instead of falling wholly within one year.

Sales of electricity in 1954-55 amounted to 523·7 million kWh. These were below expectations in some categories, but with the exception of municipal bulk supplies—the temporary arrangement with the city of Salisbury ceased in May, 1955—all classes showed increases. In million kWh the sales were as follows:—Mining 256·1, municipal 85·7, industrial 130·4, farming 25·0, and domestic and others 26·5. In 1941 the mining industry consumed 88·9 per cent of the total sales, a proportion which has steadily dropped until it is now 49·0 per cent. The reason is that while the development of electricity throughout Southern Rhodesia has continued at a high level, there has been an improving diversity in distribution of sales, indicating healthy economic development. The total increase in sales over the previous year was 7·2 per cent.

Mining Developments

Gold, asbestos and chrome constitute the main classes of mining consumer but an extension to the 33 kV system in the Shabani undertaking is in hand to afford supplies for mining beryllium, pedilite and lepidilite ores. A further extension to the north-west of Sinoia is in progress to supply a medium sized copper mine operated by the Messina (Transvaal) Development Corporation.

Since mining accounts for the consumption of over 256 million kWh, out of an annual consumption of nearly 524 million kWh, the figures, to the nearest half million, for the sales of various types of minerals in 1954 will be of interest as indicating markets for electrical goods. Values were as follows:—Gold £6½ million, coal £9½ million, chrome £12 million, asbestos £18 million and other minerals £20 million, making a total of £60 million.

The installed plant capacity rose by 30 MW to 142·5 MW. Plant on order, under construction or transfer totalled 42·5 MW. There was a general improvement in thermal efficiencies and Umniati "B" station, with an installed capacity of 80 MW, reached 21·02 per cent.

In November, 1954, coal prices were raised, but since the end of the year there has been a drop with indications of a further decrease this year.

Considerable work on both the Kariba and Kafue projects has been carried out by the Commission. During the year under review further load and system development studies and estimates, forming the basis of the projects so far as Southern Rhodesia is concerned, have been prepared for Government purposes.

Agreement with Portuguese East Africa

Discussions were held during the year with the Sociedade Hidro-Electrica de Revue with the object of obtaining a supply from its Revue River hydro station in Portuguese East Africa to augment that produced in the Commission's thermal station at Umtali. Such an arrangement would postpone further capital expenditure on thermal plant at Umtali. After the close of the financial year agreement was reached in Lisbon whereby the Sociedade will deliver power at the border near Umtali, for a period of ten years in the first instance, on terms that are advantageous to the Commission. It is hoped to have this supply available by mid-1957.

Load development in the Chipinga district, at present supplied by a small diesel generating station, has necessitated preliminary investigations into the possibilities of developing hydro-electric power on the Lusiti and Tanganda Rivers, both of which appear to be capable of some economic development on a relatively small scale.

Over 312 miles of 11 kV line was erected during the year, mainly for supplies to farms, and 17¼ miles of 33 kV superseded by 88 kV was dismantled. The mileage of line of all voltages at the year end was 6,710, a large total mileage for an annual sale of 523·7 million kWh, indicating the problems of distribution in such a sparsely populated country as Southern Rhodesia.

Another fact which emphasises this same problem is that, whilst there are 5,172 miles of 11 kV line in service, there are only 408 miles of l.v. line. The Commission has few densely settled areas in which to distribute electricity by l.v. mains, the only townships of any size being Marandellas, Sinoia, Bindura, Gwanda and Hartley, and none of these has a population exceeding 700.

Commission's Finances

Expenditure on capital account amounted to £2·6 million. Treasury advances totalled £3 million, of which £1·4 million was drawn against the International Bank for Reconstruction and Development loan.

The year's operations resulted in a total deficit of £136,662, making the accumulated deficit £172,702. Against this has been set the sum of £143,200, representing the balance of the excess provision of capital redemption provided before the consolidation of loan No. 1. The accumulated deficit carried to the balance sheet therefore becomes £29,502. The Commission has under discussion with the Government at the present time the question of capital redemption in relation to the electricity tariff structure. Increased tariffs became effective in July, 1954.

Farming consumers, at 2,236, showed an increase of 204. Excluding the difference in the two years, the consumption per farm increased by 19·63 per cent compared with 20·85 per cent in the previous year. The use of electricity for general irrigation and the irrigation of tobacco is steadily increasing.

The recent introduction of radio communication equipment comprising in the first instance four fixed stations at Bulawayo, Shabani, Que Que and Salisbury, with associated mobile field units, has facilitated maintenance and repair work on the several distribution systems and is making a considerable contribution to the continuity of supply to consumers.

Those who are interested in the Southern Rhodesian and also the Federal market for electrical goods would do well to study two very informative pamphlets, which have already been widely distributed, one under the title of "Facts for the Industrialist—Southern Rhodesia," issued by the Bureau of Industrial Development, P.O. Box 8123, Causeway, Salisbury. The other, on "Opportunity in Southern Rhodesia and Nyasaland," is issued by the Federal Authorities. The Southern Rhodesian pamphlet contains a very useful guide, "Power Distribution and the Occurrence of Minerals."

Cost Reduction

The Institute of Cost and Works Accountants, 63, Portland Place, London, W.1, has published "Cost Reduction" (price 6s). This is a report by the Institute's Research and Technical Committee prepared in conjunction with the branches through the medium of planned study. As its title suggests, the report is designed to point the way to possible sources of cost reduction and to the best methods of achieving that objective.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

SATURABLE transformers with a.c. or d.c. premagnetisation have been used for a number of years in the U.S.S.R. to improve the selectivity and sensitivity of differential protection, and their use has more recently been extended to directional and distance relays as well. The author analyses the effects of wave-character, harmonic content and phase relations of voltages and currents supplied by the saturable transformers to the relays on the response of the latter. The results of this analysis, very satisfactorily confirmed by experiments, enable the operating characteristics of a protection system using given relay types (e.g. of high resistance, or reactance) to be predicted for different setting ranges. The relay types particularly suitable for this combination with saturable transformers are electromagnetic relays or polarised relays with rectifiers. Attention is drawn to the effect of the series resistance and leakage reactance of the transformer winding which limits the current at the saturation of the voltage transformer and prevents a further rise of the flux. This acts in the sense of preventing incorrect operation of the relay.

Methods of keeping the power consumption of the relay low are also indicated and the principle of analysis evolved with reference to directional power relays is then used to show that voltage-balance differential protection, having close analogies with directional or differential-phase protection, can with similar advantages be obtained by (saturable) transformer relays. Two variants of differential-protection circuits are investigated and shown to operate satisfactorily. The simpler cases of distance and lock-in transformer relays are treated more briefly by showing and discussing their operating characteristics for different settings.—" Transformer-Type Directional, Differential and Distance Relays," A. D. Drozdov, *Elektrichestvo*, No. 1, pp. 41-49, 1956, in Russian.

D.C. Circuit-Breaker Testing

Testing high-speed d.c. breakers is a tricky job, because the d.c. generator power available is in most cases insufficient for conclusive tests and even where the powers broken are well inside the generator capacity, flashing-over of commutators and serious damage to the generator are ever-imminent dangers.

The idea of using an a.c. supply for testing d.c. circuit-breakers was first suggested and the possibility of obtaining equivalent testing conditions investigated by R. Chambrillon, but not for high-speed h.v. breakers. It is clear that any systematic investigation of the problem must be based on an analysis of the intrinsic differences of short-circuit conditions in d.c. and a.c. circuits and generators. This is presented by the authors and leads to the establishment of the conditions of the equivalence of d.c. and a.c. operated short-circuit testing installations. It is found that suitably modified a.c. testing circuits enable the tests to be carried out in a more rigorous, and therefore more conclusive, way.

The theoretical results were then used for designing the required auxiliary circuit elements and the test circuit developed was itself tried out in testing a 3,000 A high-speed breaker with full success. The results are profusely documented and illustrated.—" A Method of Testing High-Speed D.C. Circuit-Breakers with an A.C. Supply," V. Zajic, V. Taimr, M. Dolezal and J. Skaloud, *Elektrotech. Obzor*, Vol. 45, No. 2, pp. 75-83, 1956, in Czech.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Anti-Corrosion Servings

Anti-corrosion protection of buried cables and pipes may be of two types which might be termed active and passive, since the first attempts to prevent, or reduce, the corrosion processes by neutralising or reducing dangerous p.d.s, reducing the rate of chemical reactions, etc., whilst the second renders the protected lines impermeable to the noxious agents. The paper deals with the second type of protection in its up-to-date form, in particular with plastic and glass bitumen coverings. P.v.c. and polyethylene products are particularly suitable for the purpose owing to their chemical indifference, mechanical strength and the conservation of their elasticity down to temperatures of -30 deg C; on the other hand, temperature rises up to 80 and even 100 deg C are withstood by them without appreciable deterioration. That their dielectric properties are excellent is common knowledge.

The choice of the material for the protective covers will depend on whether only the lead sheath, or the armouring, too, requires corrosion protection and, more particularly, on the type of armouring used for the cable. For example, in the case of wire armours, the individual wires are plastic-covered and the coverings then made up solid. Steel-tape armours are similarly protected, but the lead sheath underneath is then separately protected by a plastic sleeve of its own. An even greater degree of protection is offered by a recently developed process of covering the cables with a bitumen-glass fibre mixture. Test results and encouraging operational experience on the use of cables with this protection are reported.—" Anti-Corrosion Coverings of Electric Cables," Silec, *R.G.E.*, Vol. 65, No. 2, pp. 80-85, February, 1956, in French.

50 c/s Traction Motors

The fact that 50 c/s traction has been introduced in a number of countries in which railway electrification is at very different stages of development (France, U.S.A.), or has been decided upon as the eventual form of general electrification, renders the problem of the direct 50 c/s drive by single-phase commutator motors particularly interesting, though it cannot be said that a really satisfactory solution is yet in sight. Such a solution would mean that 50 c/s motors would be technically and economically comparable with motors operating at $16\frac{2}{3}$ or 25 c/s which have reached a stage of perfection equivalent to that of d.c. traction motors. There is no doubt that the basic disadvantages of single-phase induction motors are more marked at higher frequencies, and that they are aggravated by the specific requirements of railway operation.

As the author shows very clearly, theoretically as well as by reference to many actual motor designs and circuits, the electrical drawbacks such as starting difficulties, bad p.f. and efficiency, sparking tendency, excessive transformer e.m.f.s, etc., can all be eliminated or reduced to a reasonable extent, but there still remain serious mechanical difficulties such as reducing the minimum accelerations to

figures consistent with the requirements of heavy traction. Until these difficulties have been overcome, the commutator motor cannot be considered for heavy traction, but only for passenger transport, preferably motor-coach operation.—" The 50 c/s Single-Phase Collector Motor for Traction Purposes," A. B. Ioffe, *Elektrichestvo,* No. 11, pp. 26-31, 1956, in Russian.

Relay Contacts

A field of research in which an ever-increasing number of investigations has definitely not resulted in clarifying the subject matter, but has rather produced widely divergent opinions, is that of switch and relay contacts. This is partly due to conflicting tendencies as regards the use of alloys of noble metals and of cheaper substitutes, whilst imposing equally severe duties on them, and partly to different test principles or conditions. The author is able to show that really systematic tests may convey a more objective knowledge of the different physical phenomena associated with contact operation under different conditions, such as contacts closing with and without current load, arcing and sparking, etc., and the response of pure, noble and base metals, and alloys, to these varying conditions. That only metallurgical and structural investigations of the contact materials can supply the clues to the solution of the important problem of the stability of the contact characteristics, and of the observed variations of contact resistance, and that they have to be supplemented by spectrographic investigations becomes quite clear from this extremely well documented contribution, the concrete results of which certainly constitute a positive advance beyond the previous unsettled stage of the problem.—" Characteristics and Comparative Tests on Relay Contacts," Th. Gerber, *Techn. Mitt. PTT,* Vol. 34, No. 1, pp. 1-26, 1st January, 1956, in French.

Integrating Meters

The author analyses the influence of asymmetries in the current loading on measurements of power losses with a single-phase I^2 type electricity meter in a three-phase distribution system. The errors due to such asymmetries are found to be of an order of magnitude completely vitiating the results, i.e. if the asymmetries are considerable, the results of the measurements become practically useless. For comparison, the performance of three-phase I^2 meters measuring power losses in the case of unbalanced current loads is investigated theoretically. The systematic error of these instruments is, within a certain range of the current asymmetry, lower than the corresponding error of the single-phase meters by as much as one full order of magnitude, and the three-phase meters have some further advantages over the single-phase type. These are, above all, much lower consumption, possibility of directly measuring heavy currents, insignificant influence of temperature on the error, etc. Technologically interesting is the fact that the components of the two types are identical, except for the winding, so that their primary costs do not differ much.—" Three-Phase MS-Integrating Electricity Meters," R. Drechsler, *Elektrotech. Obzor,* Vol. 45, No. 2, pp. 70-74, 1956, in Czech.

Electric Spark Machining

The spark-machine tool described seems to mark an important stage on the way towards the electrical machine tool of the future. It is a.c. operated and works with spark frequencies exceeding 200 kc/s, this resulting in very much shortened discharge periods with a consequent stricter localisation of the zones of temperature rise than result from more extensive and longer discharges, with a marked improvement of the surface finish. The tool can be used for almost every conventional cutting operation, viz. sawing, trimming, turning, milling, hobbing, facing, broaching, boring and grinding (polishing).

The most important advantage of the method is that holes and recesses of any desired shape can be obtained which is in many cases impossible with conventional machine tools. For example, broaching rectangular, hexagonal or other polygonal holes is quite easy, since the working electrode remains stationary, except for the vertical travel with progressing operation. For these reasons the machine is particularly suitable for the production of stamping (punching) dies, drawing and pressing tools (dies) and forging dies.

Some figures given illustrate the fact that up to 80 per cent could be saved compared with the cost of conventional toolmaking. The work is supported by a circular table the vertical travel of which is effected by an electropneumatic drive, and controlled by an automatic depth gauge. The dielectric fluid is continuously pumped into, and evacuated from, a plexiglass vessel surrounding electrode and work, so that the cuttings are continuously carried away. Many interesting details of the machine and examples of its production are shown in pictures and described, in some cases with overall cost calculations illustrating the economic advantages obtained.—" The 'Agietron,' a Practical Solution in the Field of Electric Spark-Machining," W. Ullmann, *Schweiz. Arch. angew. Wiss. Tech.,* Vol. 22, No. 1, pp. 23-28, January, 1956, in German.

Induction Motor Control

Despite the great improvement of induction motor drives in recent years by the introduction of saturable-reactor control circuits and many methods of dynamic braking of the motors, there remain a number of unsolved problems, particularly in the drives of hoisting and conveying machinery with intermittent action, where not only precise stopping at predetermined points is required, but accelerations during transient processes must be limited.

Two necessary conditions to be satisfied in this respect are that the speed control system must allow the motor to run steadily at a reduced speed, apart from steady operation at the rated speed, to ensure precise stopping, and the second, that to obtain optimum efficiency of the whole mechanism the rate of speed change during transient periods must remain approximately constant for all possible loads connected to the motor shaft. The existing control systems with saturable reactors, e.g. in reversible bridge connection, are either not economically practicable for high and medium-rating motors or, if they are irreversible, cannot assure a sufficiently rigid mechanical characteristic and the required retarding torques on the transition to the lower speed.

An improvement of the control characteristics of systems working with saturable reactors can be achieved by d.c. premagnetisation of the motor. The premagnetising d.c. is automatically controlled by negative feedback of the stator current to the field circuit of the d.c. generator, whereas the constancy of the motor speed is obtained by negative speed feedback acting on the control circuit of the saturable reactors. The latter contains a magnetic amplifier to improve the rigidity of the characteristics. The control system described is only one possible variant and its test performance fully confirmed the theoretical expectations.—" Controllable Drive by Induction Motor with Saturable Reactors and Premagnetisation of the Motor," M. G. Chilikin, M. M. Sokolov and V. I. Klyuchev, *Elektrichestvo,* No. 1, pp. 21-26, 1956, in Russian.

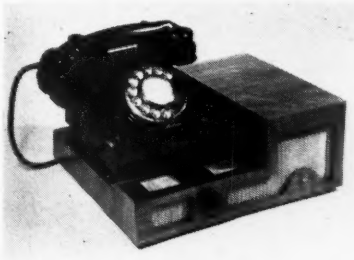
NEW ELECTRICAL EQUIPMENT

Loudspeaking Telephone

The "Plinth" loudspeaking telephone, produced by SIEMENS BROTHERS & CO., LTD., Avonmore Trading Estate, 103, Avonmore Road, London, W.14, is designed in such a manner that any ordinary automatic internal telephone may be easily adapted to give the loudspeaking facility.

Housed within the plinth, upon which the telephone stands, is a crystal microphone and moving coil loudspeaker. A combined two-position volume control and "on/off" switch is mounted on the front of the unit. The amplifier associated with the instrument is housed separately and may be mounted in any unobtrusive position, not necessarily adjacent to the telephone itself. It is unnecessary to leave the handset off the telephone in order to use the loudspeaking instrument and, where complete secrecy is required, the telephone itself may be used without the loudspeaker being in operation.

Where two or more of these units are employed upon an internal telephone system, full two way loudspeaking communication is possible without any manual operations by either of the users apart from actually establishing the call in the first instance. The apparatus does not rely upon the picking up of sound waves from the telephone earpiece as it is electrically wired to the telephone unit.

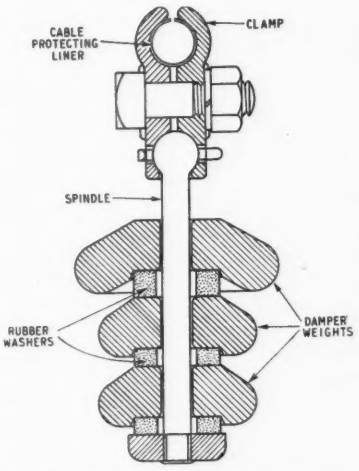


Siemens loudspeaking telephone unit

Transmission Line Dampers

METALASTIK, LTD., Evington Valley Road, Leicester, announce they have acquired the sole manufacturing rights in Great Britain of an electric transmission line damper invented by Dr. C. Granborg of the Swedish State Power Board, to be known here as the Metalastik "El-Tra-Line" damper. It is simple, robust and effective in operation, with damping efficiencies of the order of 90 per cent even for frequencies as low as five per second.

The construction is of circular weights interspersed with rubber washers or springs on a spindle hanging from a clamp on the conductor. In operation the weight of the damper moves up and down out of phase with the conductor, transforming vibration energy in the cable into the deformation of the springs. The rubber from which springs are made has good damping qualities and is electrically conductive and the complete unit is designed to avoid trouble with corona discharge. With proper tools the dampers can be fitted to live lines.



Cross-section of the "El-Tra-Line" damper

Wire Taping Machine

A new wire taping machine which eliminates bottle necks resulting from slow hand methods is announced by the MARTINDALE ELECTRIC CO., LTD., of Westmorland Road, London, N.W.9.

Developed from a device originally conceived by Mr. E. Woosey, research engineer of Lancashire Dynamo & Crypto, Ltd., the Martindale L.D.C. machine is a small portable unit which can butt or lap-tape any shaped section of medium sized conductor at speeds up to 20ft a minute. It is particularly useful in applying extra insulation at certain points of stator coils and large transformer windings, an operation at present undertaken by hand, although it may also be used effectively for the continuous taping of bare conductors.

The standard machine will take round conductors of $\frac{1}{8}$in to $\frac{3}{8}$in in diameter or rectangular wire $\frac{1}{2}$in by $\frac{1}{16}$in or $\frac{1}{4}$in by $\frac{3}{8}$in. The standard width of tape employed is $\frac{3}{8}$in and in practice it has been found that with machine taping this covers the majority of requirements. The overall speed of taping can be varied from 3ft to 20ft per minute.

8ft Fluorescent Fittings

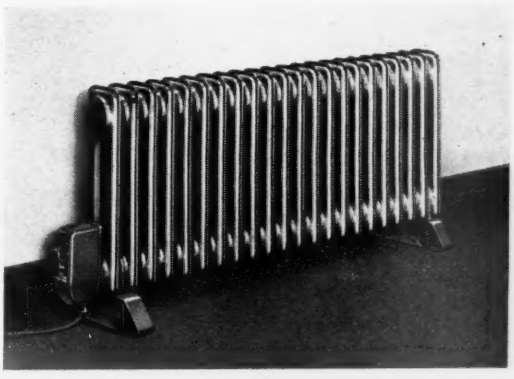
Two batten fittings have been introduced by THORN ELECTRICAL INDUSTRIES, LTD., 105-109, Judd Street, London, W.C.1, to accommodate the new "Atlas" 8ft 125 W fluorescent tubes. They are for single or twin tube operation with all gear totally enclosed in a welded steel chassis finished in "Portland Stone" enamel, and can be attached flush to the ceiling or suspended by rod or chain. Attachments are available to convert the fittings into direct lighting reflectors, and "Clipluve" diffusers can also be used.

The prices of the fittings and attachments are: Single tube 8ft batten complete with "Quickstart" gear, £11 17s, and twin tube type £18 19s; set of 8ft unslotted side reflectors, £2 16s (slotted, £3 3s). Bi-pin tubes are required with the batten fittings and the reflectors are supplied as four 4ft sections for ease of maintenance. "Atlas" fluorescent trunking has been modified so that continuous lengths of 8ft tubes complete with gear can be accommodated.

Oil-filled Radiator

The "J.10" oil-filled safety radiator introduced by HURSEAL, LTD., 229, Regent Street, London, W.1, is a two column model of 1 kW loading and is designed for maximum convected heat together with adequate radiated heat. Its low height of 17in makes it suitable for installation under windows where its high rate of convection enables heat to be circulated to all corners of the room. It can also be fitted with castors (an optional extra). The finish is in the standard colours of cream and bronze, but it can also be obtained in blue, eau-de-nil, white and gold. The price is £15 19s 6d, plus £7 0s 2d purchase tax in the United Kingdom.

Hurseal "J.10" 1 kW oil-filled radiator



DOMESTIC ELECTRICAL EQUIPMENT

Electric Toasters

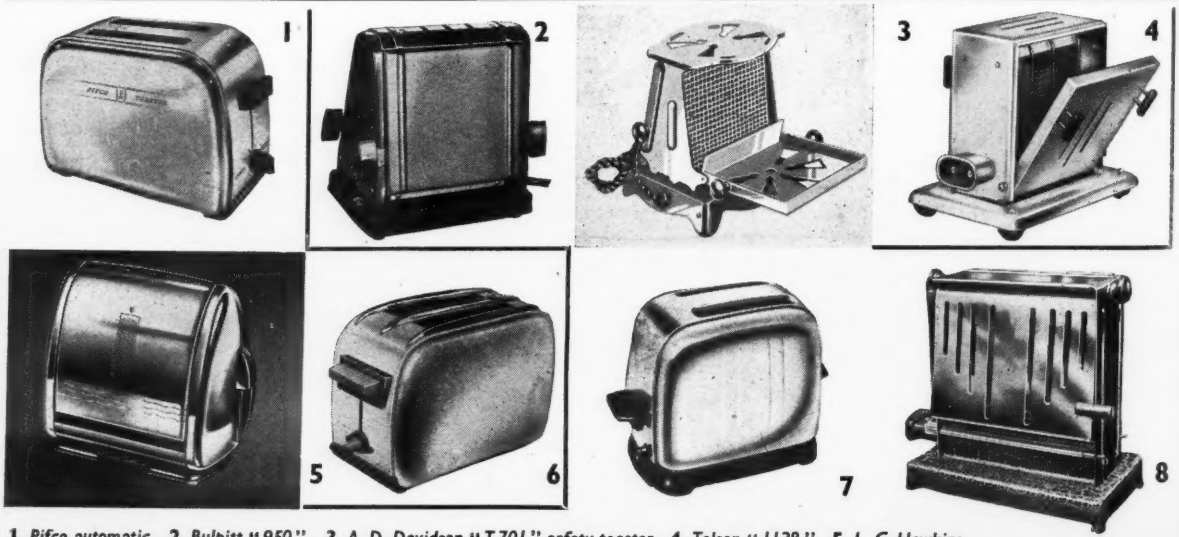
As an item of food preparation equipment the electric toaster is an attractive appliance, most modern types being chromium plated or finished in a heat resisting coloured enamel. They have been gaining steadily in popularity as more people have learned to appreciate the convenience and economy resulting from their use compared with such methods as toasting under a grill or in front of an open fire.

Two or more slices of bread can be toasted simultaneously and the automatic models, besides ejecting the toast when ready and switching off the electricity, also provide any desired degree of brownness.

Average loading of the non-automatic toasters is 500 to 600 W, use being made of one double-sided wire-wound mica element. Automatic toasters usually employ three such elements, the centre one only being double-sided, and this raises their total loading to approximately 1,250 W. While most non-automatic types can be used on either an a.c. or d.c. supply the majority of automatic toasters can only be used on a.c. owing to their switching mechanism.

The prices have been increased since they were the subject of our survey last year but this is in the main due to the fact that electric toasters are now subject to purchase tax.

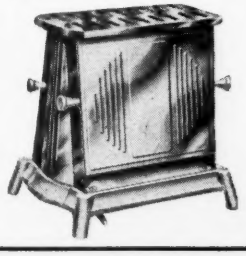
Manufacturer	Name or Model	Type	Number of Slices	Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
A.B. METAL PRODUCTS, LTD., 17, Stratton Street, London, W.1.	"Clem"	Non-Automatic	Two	600 W	Automatic turning of slices. Rubber feet	Polished Bakelite frame. Chromium doors	£2 8 9	£0 11 0½
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18.	"950"	Non-Automatic	Two	500 W	Crumb tray fixed to base	Stove enamelled light bronze, black base. Chromium top	£1 12 5	£0 7 1
A. D. DAVIDSON ELECTRIC CO., 62-66, Granville Street, Birmingham, 1.	"Davey" T.701	Non-Automatic	Two	450 W	Safety guards fitted	Chromium plated	£2 3 6	£0 9 6
DUALIT, LTD., 18-22, Penarth Street, Ilderton Road, New Cross, London, S.E.15.	"147"	Non-Automatic	Two	500 W	Automatic turning of slices	Chromium plated	£2 5 0	£0 11 0
	"Semi 3"	Semi-Automatic	Three	1,500 W	Push-button toast ejection	Chromium plated	£5 5 0	—
	"Semi 4"	Semi-Automatic	Four	2,000 W	Push-button toast ejection	Chromium plated	£8 8 0	—
	"Semi 6"	Semi-Automatic	Six	3,000 W	Push-button toast ejection	Chromium plated	£12 12 0	—
	"Auto 3"	Fully Automatic	Three	1,500 W	Electric clock movement. Indicator lamp	Chromium plated	£10 10 0	—
	"Auto 4"	Fully Automatic	Four	2,000 W	Electric clock movement. Indicator lamp	Chromium plated	£14 14 0	—
	"Auto 6"	Fully Automatic	Six	3,000 W	Electric clock movement. Indicator lamp	Chromium plated	£19 19 0	—



1. Pifco automatic. 2. Bulpitt "950". 3. A. D. Davidson "T.701" safety toaster. 4. Telsen "1138". 5. L. G. Hawkins "L.G.H.1421". 6. Falk Stadelmann "U.95625". 7. G.E.C. "D. 5625" automatic. 8. Dualit "147" non-automatic

Manufacturer	Name or Model	Type	Number of Slices	Loading	Special Features	Finish	Price (excl. tax)	Purchase Tax
EASIPOWER, LTD., 213-215, Gloucester Place, London, N.W.1.	"Easipower"	Non-Automatic	One	600 W	Toasts both sides at once. Finger-tip control	Chromium plated	£2 7 6	£0 10 6
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	"Auto-Toaster" U.95625	Automatic	Two	1,200 W	Thermostatically compensated timing device, a.c./d.c.	Chromium plated	£5 10 0	£1 4 2
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.	D.5605A	Non-Automatic	Two	600 W	Automatic turning of slices	Polished aluminium	£2 2 0	£0 9 3
	D.5620	Non-Automatic	Two	600 W	Automatic turning of slices. Removable doors	Chromium plated	£3 15 0	£0 16 5
	D.5625	Automatic	Two	1,250 W	Automatic toast ejection	Chromium plated	£5 5 0	£1 3 0
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	L.G.H.1321	Non-Automatic	Two	525 W	Automatic turning of slices	Chromium plated	£2 9 6	£0 10 10
	L.G.H.1421	Non-Automatic	Two	525 W	Single-action handle opens both doors simultaneously	Chromium plated	£2 12 6	£0 11 6
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Fletton, Peterborough.	80854	Non-Automatic	Two	600 W	Automatic turning of slices	Polished stainless steel	£2 15 0	£0 12 1
MORPHY-RICHARDS, LTD., 6, Conduit Street, London, W.1.	TA/1B	Automatic	Two	1,250 W	Trip-button for immediate release of toast, a.c. only	Chromium (*a*) or primrose, bronze, blue or green (*b*)	£5 5 0 (*a*) £4 19 6 (*b*)	£1 2 9 (*a*) £1 1 7 (*b*)
	TU/1D	Automatic	Two	1,250 W	Trip-button for immediate release of toast, a.c./d.c.	Chromium (*a*) or primrose, bronze, blue or green (*b*)	£5 15 0 (*a*) £5 9 6 (*b*)	£1 4 11 (*a*) £1 3 9 (*b*)
NEW FOREST SERVICES (LYNDHURST), LTD., High Street, Lyndhurst.	"Don"	Non-Automatic	Two	500 W	Automatic turning of slices	Chromium plated	£2 2 0	£0 7 6
ORMOND ENGINEERING CO., LTD., Rosebery Avenue, London, E.C.1.	"Ormond"	Non-Automatic	Two	600 W	Automatic turning of slices	Chromium plated and cream Bakelite	£1 17 6	£0 8 3
PIFCO, LTD., Watling Street, Manchester, 4.	"Pifco"	Automatic	Two	1,250 W	Automatic toast ejection. Simplified timing device	Chromium plated. Black plastic handles	£5 14 5	£1 5 1
PREMIER ELECTRIC HEATERS, LTD., Keeley Street, Birmingham, 9.	"916"	Non-Automatic	Two	600 W	Automatic turning of slices	Polished alloy	£2 5 0	£0 9 11
	"918"	Non-Automatic	Two	600 W	Automatic turning of slices	Chromium plated	£2 15 0	£0 12 1
TELSEN ELECTRIC CO. (1935), LTD., Fitzgeorge Street, Manchester, 9.	"1138"	Non-Automatic	Two	400 W	Automatic turning of slices	Nickel plated	£1 10 0	£0 7 2

9



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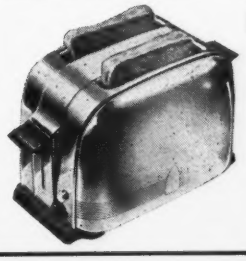

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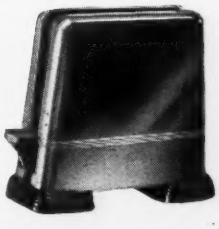

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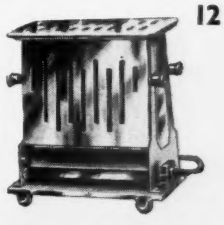

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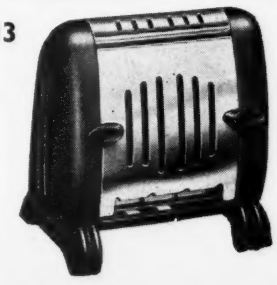
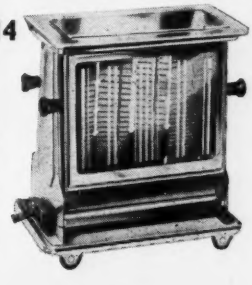
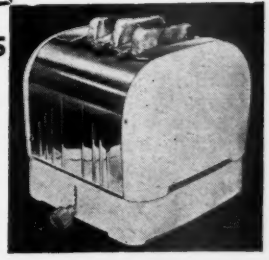


9. Ormond non-automatic
10. Morphy-Richards TA/1B automatic
11. Easipower tip-toaster
12. Premier "916"
13. "Clem" (A. B. Metal Products, Ltd.)
14. Hotpoint "80854"
15. Dualit "Semi-Three"

14



15



Irish Hydro-electric Scheme

Progress of River Lee Development

Above: The dam and power station under construction at Inniscarra. Left: Aerial view of work at Carrigadrohid

THE River Lee hydro-electric scheme, on which construction began in April, 1953, and which it is hoped will be in operation by the spring of next year, will bring the number of water power generating stations in the Irish Republic up to eight. It involves the construction of two dams on the River Lee, one at Inniscarra in a rocky gorge nine miles upstream from Cork City and a smaller one at Carrigadrohid, some ten miles farther upstream. Two roughly equal storage lakes are being created with a combined useful storage capacity of 5·2 per cent of the annual river inflow, and a total area of about 3,500 acres. It is thus a run-of-the-river scheme, whose full generating capacity will be available mainly during times of heavy flow and for peak load periods. The Lee scheme will also provide standby capacity for the important load centre at Cork.

Two power stations are being built, one at each dam. That at Inniscarra will house two generators (15 MW and 4 MW). These will be driven by turbines of 21,600 h.p. and 5,800 h.p. respectively. The Carrigadrohid station, which will be completely controlled from Inniscarra, is being equipped with a single 8 MW generator coupled to an 11,600 h.p. turbine. A 110 kV switching station will be constructed at Inniscarra, the combined output of the two stations being fed over a single-circuit line to the Kilbarry transformer station in Cork. Production from the scheme is expected to be about 68 million kWh per annum eventually.

At Carrigadrohid the dam is about 350ft in length, with a maximum height of 70ft, and the generating station is being built into the dam.

At Inniscarra construction of foundations 50ft below river level in gravel overburden requires the diversion of the river during construction into a 1,100ft long channel which has been cut into rock in the slope of the valley along its south side. The Inniscarra dam will be about 800ft long and 140ft high and will have an 8ft wide walkway along its crest. The power station is to be situated immediately downstream of the intake blocks of the dam.

The Inniscarra fish pass is to be similar to that already built and tested out over five years at Leixlip on the River Liffey.

As a result of the River Lee hydro-electric scheme and other similar projects it is estimated that the Irish Electricity Supply Board will be able to supply the total demand for electrification in all parts of rural Ireland by 1959.

Prospects in Libya

The consumption of electricity in Libya is increasing and is likely to increase more rapidly when the proposed new Tripoli power scheme is carried out. This is stated in a report by Mr. H. H. Thomas, former Counsellor (Economic) at H.M. Embassy in Libya, on the economic and commercial conditions in Libya (H.M. Stationery Office, 3s net). The market for basic electrical supplies and household appliances should be an expanding one over the next five years, but there is no early prospect of anything but a limited market for heavy electrical equipment, with the exception of the substantial orders that the new Tripoli Electricity Corporation will be placing. These may be of the order of £2 million. Hitherto Italy has led the field, with the United Kingdom in second place, due no doubt to the fact that the power and light concessionaires in Tripoli, the Societa Elettrica Commerciale e Industriale, are Italian.

The Libyan-American Reconstruction Commission has contributed £1 million towards the Tripoli power scheme, and it is estimated that a further £2¼ million will be required. The present concessionaires are to be bought out and a public corporation set up to operate the new venture. A British firm of consulting engineers has prepared plans for installing new plant and expanding the output to cover the whole of Tripolitania. The prime objective will be to provide cheap power for agriculturalists. The existing installation is very much run down and urgently needs replacement.

NEW BOOKS

Noise. By Aldert Van der Ziel. Pp. xi + 450; figs. 97. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s.

In this book Professor Van der Ziel covers the whole field of spontaneous electrical fluctuations included in the general (though now rather inaccurate) term noise. The reader may be left somewhat breathless after working through the book; he will have been led, after early chapters on noise effects in a comprehensive variety of circuits, to discussions of noise effects in vacuum tube electronics, and the properties of electron beams generally, and the general problem of the limitation of sensitivity of instruments by noise effects, by way of brief chapters on statistical mechanics and the Fourier analysis of fluctuating quantities.

The earlier chapters, which form some three-quarters of the book, introduce Nyquist's theorem and apply it in discussions on the noise figures of networks, amplifiers and receivers. In these chapters, and indeed throughout the book, the author's style is agreeably terse, and the derivations of expressions employed are skilfully condensed: significant omissions are, however, invariably pointed out. Methods of noise measurement are then described, and succeeding chapters discuss tube noise at low frequencies and in the more complex case of high and very high frequencies. A chapter on low-noise circuits deals with the desirable modifications in the basic grid-, cathode- and anode-grounded circuits, with some attention to other low-noise circuits. A lengthy chapter describes semi-conductor devices including point contact and junction diodes and transistors, and the thermal and shot noise, also the excess noise observed in them; the excess noise observed in tubes is also discussed. Chapters on noise in mixer tubes and circuits, and on the effect of feedback on circuit noise, conclude the chapters on circuit effects, with the exception of the later chapter on noise in detector circuits; this is mathematically more sophisticated, utilising probability distribution functions.—P.L.D.

Handbook of Industrial Engineering and Management. By W. G. Ireson and E. L. Grant. Pp. 1,203; figs. Bailey Bros. & Swinfen, Ltd., 46, St. Giles High Street, London, W.C.2. Price 168s.

This volume is similar to a number of other handbooks published in the United States, in that it consists of seventeen different sections which cover all aspects that are likely to be met in the sphere of industrial engineering. A short autobiography of the authors of each of these sections, which describe a particular branch of the subject in some detail, indicates that a vast amount of experience has been tapped to compile the handbook and although, as can be expected, the majority of references are made to American factories, publications and personalities, it is refreshing to note some reference to factories and individuals known on this side of the Atlantic, including one section by a British author.

The normal industrial engineering subjects, such as motion and time study, plant layout, materials handling, job evaluation, production control and tool engineering are included. Other closely allied subjects, references to which may often be required but usually are only to be found after recourse to a technical library and much weary search through full-length textbooks, are also given full sections. These include subjects such as industrial statistics, engineering economy, quality control and industrial budgeting.

It is somewhat difficult to select any particular portion of the handbook for comment, each section of which quite adequately covers its own subject. There are many sections which will prove of use and interest to the non-technical but in parts, of necessity, a knowledge of engineering mathematics will be required. This comes to particular notice in the section on industrial statistics. Throughout, however, good use is made of examples from industrial problems, which keeps all subjects to a practical level. As a handbook for industrial engineers this volume should prove most helpful to readers, both in the revision of subjects where knowledge has been held previously or as an introduction to a new subject.—C.M.H.

Electronic and Radio Engineering. By F. E. Terman. Pp. 1,078; figs. McGraw Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 71s 6d.

This book is the fourth edition of "Radio Engineering," a textbook which is well known to all radio engineers. A great deal of new material has been included in the new edition and much of the original work has been revised in accordance with current ideas.

The text is divided into three sections. The first deals with circuit elements, including transmission lines and waveguides, the second and largest section covers valve and transistor circuits, and the last section deals with radio propagation and communications systems.

In the second section, the treatment of video and tuned amplifiers is from the point of view of transient response replacing the former treatment involving the c.w. response. New material includes chapters on pulse techniques, microwave valves and semi-conductor devices. New material in the last section relates to microwave aerials, television (including colour television) and radar and navigational systems.

As one has come to expect from a book by Terman, the treatment of the various subjects is lucid and easy to read, appeal to physical argument being preferred to mathematical analysis in many cases. At the end of each chapter there are approximately forty problems but unfortunately answers are not provided.

Apart from its uses for the student, the practising engineer will find this an excellent reference book for its simple explanation of new devices, and also the large collection of design data, both theoretical and empirical. The book has a comprehensive index, both to subject matter and authors referred to in the bibliography, and in the reviewer's opinion is one of the best surveys of the electronic and radio engineering field available at the present time.—H.B.W.

BOOKS RECEIVED

Steels for the User. By R. T. Rolfe, O.B.E., F.R.I.C., F.I.M. 3rd edition revised. Pp. 399; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

Handbook of Engineering Materials. By D. F. Miner and J. B. Seastone. Pp. 1,093; figs. (John Wiley & Sons Inc., New York.) Chapman & Hall, Ltd. Price 140s.

Radio and Electronic Components. Vol. 1. **Fixed Resistors.** By G. W. A. Dummer, M.B.E., M.I.E.E. Pp. 187; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 28s.

Practical Metrology. By K. J. Hume, B.Sc., M.I.Mech.E., M.I.Prod.E. and G.H. Sharp. Vol.2. Pp.71; figs. MacDonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 7s.6d.

Testing Electrical Installations and Machines. Edited by E. Molloy. Fifth edition. Pp. 200; 125 illus. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 12s 6d.

Magnetism and Electricity. By J. M. R. Sutton, B.Sc. Vol. 1. Pp. 266; figs. (Technical College Series). The English Universities Press, Ltd., 102, Newgate Street, London, E.C.1. Price 8s 6d.

Germanium Diodes. By Dr. S. D. Boon. Pp. 93; figs. Cleaver Hume Press, Ltd., 31, Wrights Lane, Kensington, London, W.8. Price 9s 6d.

Frequency Response. Edited by Rufus Oldenburger, Ph.D. Pp. 372. The Macmillan Co., 10, South Audley Street, London, W.1. Price 52s 6d.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 27th June from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

25524. Elliott Bros. (London), Ltd., and Acheson Colloids, Ltd.—Manufacture of electric resistance elements. 19th October, 1951. (751001.)

1952

16111. British Thomson-Houston Co., Ltd.—Binary digital computing and counting apparatus. 26th June, 1952. (751592.)

32133. Bendix Aviation Corporation.—Digital computer for performing integration and differential analysis. 18th December, 1952. (751101.)

1953

4721. Tinsley (Industrial Instruments), Ltd., and Steghart, F. L. F.—Thermionic valve amplifiers. 19th February, 1954. (751474.)

10211. Metropolitan-Vickers Electrical Co., Ltd.—Linear accelerators for charged particles. 14th April, 1954. (751353.)

14474. El-Re-Ma Soc. Anon. per Lo Sfruttamento di Brevetti.—Electro-magnetic relays. 22nd May, 1953. (751478.)

16167. Junghans, H.—Telephone handsets. 11th June, 1953. (751009.)

16921. Clang, Ltd., Harwood, C. D., and Austen, H. E.—Snap-action electric switches. 9th September, 1954. (751480.)

18444. Bailey Meters & Controls, Ltd.—Television apparatus. 2nd July, 1954. (751481.)

24128. Thompson & Co. (Sunbury), Ltd., R. E.—Snap-action device particularly for thermally operated electric switches. 1st December, 1954. (751483.)

26445. International Business Machines Corporation.—Transistor circuits. 25th September, 1953. (751595.)

30532. Marconi's Wireless Telegraph Co., Ltd.—Frequency response adjusting and correcting electrical networks. 2nd September, 1954. (751486.)

35463. Crabtree & Co., Ltd., J. A., and Wintle, T. D. G.—Electric snap-action switches. 29th September, 1954. (751489.)

1954

283. General Electric Co.—Magnetic programming apparatus for example for use in controlling a mechanism. 5th January, 1954. (751360.)

1447. Deutsche Electronik Ges.—Electronic vacuum tubes. 18th January, 1954. (751229.)

1595/7. Philips Electrical Industries, Ltd.—Transformers for high frequency heating generators. 19th January, 1954. (751020/2.)

1884. General Electric Co.—Magnetic aluminium-iron alloys. 21st January, 1954. (751369.)

2767. Philips Electrical Industries, Ltd.—Electric discharge tubes comprising a plurality of electrode systems. 29th January, 1954. (751373.)

2770. Philips Electrical Industries, Ltd.—Amplifying circuits embodying transistors and discharge tubes. 29th January, 1954. (751112.)

2986. Sylvania Electric Products, Inc.—Mount-sealing apparatus for tubular electric lamps. 1st February, 1954. (751376.)

3578. Siba-Eliktrik Ges.—Electric control apparatus. 8th February, 1954. (751235.)

4059. Berthier, E. A.—Electric circuit-breaker. 11th February, 1954. (751117.)

4189. Childs, P. A.—Electrical coupling of movable and fixed apparatus. 10th February, 1955. (751381.)

4213. Philips Electrical Industries, Ltd.—Cathode bodies. 12th February, 1954. (751507.)

4518. English Electric Co., Ltd.—Electric motor driven rollers. 15th February, 1955. (751383.)

4611. Cottrell, F. W.—Fluorescent lamp starter switch incorporating cut-out and hold-out switch. 17th February, 1954. (751509.)

5322. British Thomson-Houston Co., Ltd.—Electrical pulse circuit arrangements. 23rd February, 1954. (751120.)

5558. Erie Resistor Corporation.—Wave guides and transmission lines. 25th February, 1954. (751385.)

5718. Babcock & Wilcox, Ltd.—Method of firing coal with a high ash melting point in slag tap furnaces. 26th February, 1954. (751241.)

5744. Naamlooze Vennootschap Coq.—Electrical switching devices for high tension. 26th February, 1954. (751513.)

6013. McLean, G. O., and Milne, A. G.—Supporting and insulating systems for overhead electric lines. 14th February, 1955. (751124.)

6236. Philips Electrical Industries, Ltd.—Methods of producing semi-conductive monocrystals. 3rd March, 1954. (751126.)

7039. Cinch Manufacturing Corporation.—Contact members for a holder for a thermionic valve, plug or like electrical device having projecting terminal prongs. 10th March, 1954. (751517.)

7359. Loewe Opta Akt.-Ges.—Method of fastening the electrodes in electronic beam valves. 12th March, 1954. (751520.)

7763. Philips Electrical Industries, Ltd.—Electric discharge tubes. 17th March, 1954. (751251.)

7972. Compagnie Générale de Télégraphie sans Fil.—Pulse modulating circuits for wave tubes of the crossed-field type. 18th March, 1954. (751034.)

8063. Imperial Chemical Industries, Ltd., and Thorley, T.—Electric arc welding apparatus. 21st March, 1955. (751394.)

8194. Siemens-Schuckertwerke Akt.-Ges.—Cooling of high voltage electric machines. 19th March, 1954. (751256.)

8398. Ebauches Soc. Anon.—Method and circuit for transforming a stored quantity of electricity into a number of electric pulses proportional to this quantity. 23rd March, 1954. (751259.)

8771. Naamlooze Vennootschap Hollandse Signaalapparaten.—Radar auto-follow apparatus. 25th March, 1954. (751137.)

8883. Bailey Meters & Controls, Ltd.—Electric resistance thermometer units and the manufacture thereof. 26th March, 1954. (751398.)

8988. Yardney International Corporation.—Inter-electrode separators for electric cells. 26th March, 1954. (751528.)

9321. Kaiser Aluminium & Chemical Corporation.—Electric cable construction. 30th March, 1954. (751036.)

9324. Lignes Telegraphiques et Telephoniques.—Inductance coils having ferromagnetic cores. 30th March, 1954. (751037.)

9947. General Electric Co.—Manufacture of semi-conductor devices. 5th April, 1954. (751143.)

10102. British Thomson-Houston Co., Ltd.—Control circuits for compole d.c. machines. 18th March, 1955. (751144.)

10232. Gutschera, G.—Reciprocating electric motor pumps. 7th April, 1954. (751039.)

10238. General Electric Co.—Electrical insulating materials incorporating asbestos. 7th April, 1954. (751145.)

10369. Philips Electrical Industries, Ltd.—Electroluminescent sign devices. 8th April, 1954. (751404.)

10493. Standard Telephones & Cables, Ltd.—Electromagnetic transducers for electromagnetic recording and reproducing. 9th April, 1954. (751405.)

10548. Akt.-Ges. Brown, Boveri & Cie.—Method of removing deposits from machine elements in thermal power plants and arrangements for performing the method. 9th April, 1954. (751146.)

11398. Hamilton, W. M.—Methods of and apparatus for radiating and receiving microwaves. 20th April, 1954. (751041.)

11626. Suzuki, K.—Electric switch contacts. 22nd April, 1954. (751399.)

11835. Philips Electrical Industries, Ltd.—Direct voltage amplifier circuits. 23rd April, 1954. (751533.)

11969. Western Electric Co., Inc.—Apparatus for guiding electro-magnetic wave energy. 26th April, 1954. (751153.)

12152. Radio Corporation of America.—Semi-conductor devices and method of making same. 27th April, 1954. (751408.)

12168. General Electric Co.—Electroluminescent phosphor screens. 27th April, 1954. (751047.)

12500. Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St. Gobain, Chauny et Cirey.—Electrical connectors for resistance elements on glass plates. 29th April, 1954. (751536.)

12608. Philips Electrical Industries, Ltd.—Electric incandescent lamps or discharge tubes. 30th April, 1954. (751537.)

12663. Radio Corporation of America.—Method and apparatus for making semi-conductor devices. 30th April, 1954. (751278.)

12692. Telefunken Ges.—Phase compensating elements. 30th April, 1954. (751155.)

13837. Westinghouse Electric International Co.—Vapour electric discharge lamps. 12th May, 1954. (751283.)

14044. Akt.-Ges. für Unternehmungen Der Eisen-Und Stahlindustrie.—Drum magnet separator. 13th May, 1954. (751415.)

14328. Telefunken Ges.—Electrostatic electron lenses. 17th May, 1954. (751540.)

14485. Compagnie Générale de Télégraphie sans Fil.—Direction finding systems. 17th May, 1954. (751541.)

14635. Telefunken Ges. — Electrode assemblies for electron discharge devices. 19th May, 1954. (751285.)

15091. Gardner, A. L.—Apparatus for concentrating solar energy. 21st May, 1954. (751050.)

15351. Record Electrical Co., Ltd.—Electrical indicating instruments. 25th May, 1954. (751544.)

15482. Elgin National Watch Co.—Electrical energy producing cells. 26th May, 1954. (751290.)

15833. Standard Telephones & Cables, Ltd.—Sheathing of electric cables with light metal. 28th May, 1954. (751292.)

16371. Bremer, R. C.—Methods of drying wood by the use of high frequency dielectric heating and hot air. 2nd June, 1954. (751054.)

16723. Sulzer Frères Soc. Anon.—Removal of salts from return flow condensate in steam power plants. 8th June, 1954. (751173.)

17265. Stichting voor Fundamenteel Onderzoek der Materie.—Nuclear reactor. 11th June, 1954. (751429.)

17642. Westinghouse Electric International Co.—Electrostatic precipitators. 16th June, 1954. (751548.)

18326. Petri, W. (trading as Petri Komm.-Ges., W.).—Electric branch terminal connectors. 22nd June, 1954. (751552.)

18569. General Electric Co.—Vacuum cleaners. 24th June, 1954. (751300.)

18683. Standard Telephones & Cables, Ltd.—Multi-channel radio signalling system. 25th June, 1954. (751179.)

18844. Sulzer Frères Soc. Anon.—Operation of super critical pressure forced flow once-through steam generators. 28th June, 1954. (751553.)

19247. Sylvania Electric Products, Inc.—Manufacture of electronic tubes. 30th June, 1954. (751061.)

19926. Allgaier-Werke Ges.—Process and device for driving a working machine by means of several natural power machines with varying outputs and/or speed of revolution, in particular wind power plant, water turbines or the like. 7th July, 1954. (751184.)

20156. Benjamin Electric, Ltd.—Light transmitting louvre constructions. 9th July, 1954. (751559.)

20300. Fernseh Ges.—Electrical apparatus. 12th July, 1954. (751561.)

20960. Research Products, Inc.—Electrical circuits for telephone systems. 19th July, 1954. (751564.)

21162. Fiat Soc. Per Azioni.—Method of manufacturing curved flanged members, more particularly pole pieces for dynamo-electric machines. 20th July, 1954. (751187.)

21300. Compagnie Générale de Télégraphie sans Fil.—Very short wave radio transmitting arrangements. 21st July, 1954. (751188.)

21591. Planer, V., and Planer, G. V.—Insulated electric conductors. 23rd July, 1954. (751565.)

22191. Rosenthel-Isolatoren Ges.—Non-vitreous electric resistors. 29th July, 1954. (751066.)

22454. Aktiebolaget Elektrolux.—Electrically driven kitchen machines. 3rd August, 1954. (751067.)

22881. Allmanna Svenska Elektriska Aktiebolaget.—Over-voltage protection device. 6th August, 1954. (751443.)

22964. General Electric Co.—Brush holders for dynamo-electric machines. 6th August, 1954. (751193.)

23413. Pritikin, N.—Method of making inlaid electrical circuits. 12th August, 1954. (751445.)

23741. Hughes, V. A. B. (Electric Storage Battery Co.).—Negative electrodes for electric batteries. 16th August, 1954. (751320.)

24037. Naamlooze Vennootschap Coq.—Electrical apparatus, such as liquid immersed switches, comprising means for discharging gases produced during operation of the apparatus. 18th August, 1954. (751324.)

24961. Philips Electrical Industries, Ltd.—Methods of sealing or subdividing glass envelopes of cathode ray tubes and devices for carrying out such methods. 27th August, 1954. (751196.)

25839. Volk, A.—Self-starting single-phase induction motors. 6th September, 1954. (751198.)

26237. Bosch Ges., R.—Frames for dynamo-electric machines and their manufacture. 10th September, 1954. (751334.)

26794. Steen, C. A.—Electric steam generating devices. 15th September, 1954. (751200.)

27034. Harnischfeger Corporation.—Driving and braking circuit for an electrically driven apparatus. 17th September, 1954. (751082.)

27672. Hanovia Chemical & Manufacturing Co.—End fittings for vapour arc lamps. 24th September, 1954. (751583.)

28961. Job, F., and Clavier, P. Jean-.—Remote power supply systems for telephone repeaters. 7th October, 1954. (751340.)

29487. Standard Telephones & Cables, Ltd.—Electrical indicating and/or control panels. 13th October, 1954. (751205.)

32569. General Electric Co.—Dishwashing machines. 10th November, 1954. (751347.)

32846. British Thomson-Houston Co., Ltd.—Electric protective arrangements. 12th November, 1954. (751214.)

33560. Westinghouse Electric International Co.—Dynamo-electric machines. 19th November, 1954. (751349.)

33664. Libbey-Owens-Ford Glass Co.—Electrically conductive windshield. 22nd November, 1954. (751468.)

36846. Generator Holding Establishment.—Compound wound synchronous generator sets. 20th December, 1954. (751220.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—4th July. Victorian Railways. Fluorescent lighting fittings and ballast shrouds. (E.S.B. 14598/56. Ten/19739.)*

19th September. State Electricity Commission of Victoria. 330 kV transmission line. (E.S.B. 15054/56. Ten/19795.)*

Brentford and Chiswick.—20th July. Borough Council. Internal telephone system. (See this issue.)

Egypt.—5th September. Cairo Electricity and Gas Administration. Underground cable. (E.S.B. 14992/56. Ten/19775.)*

India.—Mysore Iron and Steel Works. Electric arc furnace, electric overhead cranes, electrical and mechanical equipment, etc. (E.S.B. 14063/56. Ten/19741.)*

30th June. Government of Rajasthan, Irrigation Department. One 30 kVA, two 200 kVA and two 400 kVA transformers. (E.S.B. 14980/56. Ten/19765.)*

30th August. Chief Engineer, Electrical and Mechanical Department. Two additional 4,500 kW generating sets for Sindh Valley power house, Kashmir, and two 3,200 or 4,500 kW generating sets for Jhelum Valley powerhouse. (E.S.B. 14471/56. Ten/19742.)*

Irish Republic.—26th June. Eire Commissioners of Public Works. Electrical installations in Kinnity Castle, Offaly, and premises at Falcarragh, Co. Donegal. J. Tyrrell, Office of Public Works, 51, St. Stephen's Green, Dublin.

23rd July. Kerry County Council. Two electrically driven centrifugal sewage pumping sets. (E.S.B. 14992/56. Ten/19744.)*

London.—3rd August. India Store Department. Wireless set and station No. 62, and vertical aerials. (See this issue.)

Newcastle-on-Tyne.—16th July. Education Committee. Electrical installation at the Firfield Boys' Secondary Modern School. Cairns and Byles, consulting engineers, 8, Osborne Road.

New Zealand.—6th July. Ministry of Works. Indoor type metalclad switchgear and ancillary equipment. (See this issue.)

6th July. Post and Telegraph Department, Wellington. Instrument and switchboard cords. (E.S.B. 15062/56. Ten/19807.)*

Sale.—29th June. Borough Council. Lighting of Marsland Road to Group "A" standard, including 55 columns complete with lanterns, sodium discharge lamps and time switches. Borough engineer, Town Hall.

South Africa.—4th July. Stores Department, South African Railways. 6,740 lightning protectors. (E.S.B. 14945/56. Ten/19808.)* 6th July. Copper wire and telephone cable. (E.S.B. 14765/56. Ten/19750.)*

Tangier.—7th August. Water and Electricity Board. Three-phase transformers. (E.S.B. 13861/56. Ten/19738.)*

Thailand.—31st July. Royal Irrigation Department, Bangkok. Seven diesel engine units to drive a 16 kW generator and one diesel engine unit to drive a 18 kW generator. (E.S.B. 15029/56. Ten/19797.)*

Turkey.—1st July. Turkish Economic Mission, Washington. Two 1,200-1,400 kVA, 4 kV transformers and one 100-125 kVA, 231 kV transformer and accessories. (E.S.B. 15157/56.I.C.A. Ten/19818.)*

Uruguay. — 18th September. General Administration, U.T.E. Cables and junction boxes. (E.S.B. 14523/56. Ten/19779.)*

West Ham.—6th July. Borough Council. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Isle of Ely.—County Council Education Committee. Electrical equipment at Queen's Boys' School, Wisbech (£8,323).—Harry Carr.

Lancashire.—County Council Education Committee. Recommended. Electrical installation works at Audenshaw Poplar Street Secondary and County School (£1,250).—Electric House (Denton).

Newcastle-on-Tyne. — Regional Hospital Board. Goods lift at Prudhoe and Monkton Hospital, Prudhoe (£1,620).—Evans Lifts.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Extensions to secondary school (£120,000); R. Costain, Great North Road, Newcastle-on-Tyne.

Barnard Castle.—Flats (48) for the R.D.C.; J. Lawton, Galgate, Barnard Castle.

Barnet.—Houses (263), Whitings Hill estate (Section III); R. G. Narberth, U.D.C. surveyor, Ravenscroft House, Wood Street.

Bebington.—Dwellings (112) at Mill Park estate, Eastham; L. Birch, borough surveyor, Brackenwood, Bebington, Wirral, Ches.

Belfast.—Government factory at Castlereagh estate for lease to the Mission Manufacturing Co., Ltd.; S. Stevenson & Sons, architects, 83, Royal Avenue.

Old people's home, Bawnmore (£80,000); City Council.

Belford.—County school; county architect, County Hall, Newcastle-on-Tyne.

Houses at Lucker for R.D.C. (£25,000); J. Sample and Son, builders, Warkworth.

Betchworth.—Research laboratory for Beecham Research Laboratories, Ltd., Brockham Park, Betchworth (Surrey); F. Senior, architect, Ditsworthy, Lowfield Heath, Crawley, Sussex.

Birmingham.—Eight-storey flats (88), Melville Court, Edgbaston; A. G. Sheppard Fidler, city architect, Civic Centre.

Bradford.—School, Netherlands Avenue; A. J. P. Pashler, consulting engineer, 50, Newhall Street, Birmingham.

Bristol.—Terminal buildings, Lulsgate Airport; city architect.

Scheme for development of the Knowle stadium site, for over 200 houses; Alec French and Partners, architects to developers, Halifax House, St. Augustine's Parade, Bristol, 1.

Carlisle.—Flats (52); L. J. A. Stow, city engineer, 18, Fisher Street.

Chester-le-Street.—Council offices; F. Bowman, architect, Estate Office, Birtley.

Chesterfield.—Factory on 30-acre site at Eckington; J. R. Bramah and Co., Ltd., sheet metal workers, 127, Devonshire Street, Sheffield, 3.

Chorley.—St. Augustine's R.C. Secondary School for Boys, Carr Lane (£100,000); Lancs county architect, Fishergate Hill, Preston.

Coseley.—Houses (100) at Wallbrook; J. C. Roper, clerk to U.D.C., Council House, Coseley, Staffs.

Coventry. — Housing estate, Ernsford Grange; Whitmore Park Estate Co., Ltd., 29, Warwick Road.

Crawley.—Church, Three Bridges Road; H. S. Goodhart-Rendel, architect, Kirkland House, Whitehall, London, S.W.1.

Cullercoats.—Methodist church in Broadway (£15,000); Cackett, Burns, Dick & McKellar, 21, Ellison Place, Newcastle.

Cumbernauld.—Houses (400) as first development of new town (near Glasgow); Gillespie, Kidd & Coia, architects, Park Circus, Glasgow.

Dartford.—Mill for Dartford Paper Mills, Ltd.; James Longley & Co., Ltd., builders, Joinery Works, Crawley.

Dewsbury.—Dwellings (125), Owl Lane; borough architect.

Easington (Co. Durham).—Houses (24), Horden, and shops on various sites; R. R. Lumsden, R.D.C. surveyor.

Eastbourne.—Crematorium at Langney (£57,275); R. Williams, borough surveyor, 2/4, Saffrons Road.

Erith.—Flats (48) and shops (6) at Picardy Street, Belvedere; J. J. Stevens & Sons, quantity surveyors to B.C., 52, Ebury Street, London, S.W.1.

Evesham.—Office buildings for new sewage works; Pemberton & Bateman, architects, 21, Vine Street.

Failsworth.—Houses (40) on sites at Clive Road, off Ashton Road West, and Coronation Road extension; U.D.C. surveyor, Town Hall, Failsworth, near Manchester.

Gateshead.—Block of stores, High Street, Harrop, Ltd., furnishers; Vincent Burr & Partners, 85, Gower Street, London, W.C.1.

Gloucester.—Dwellings (244) on the Innsworth Grove site at Churchdown, for R.D.C.; W. J. Knight, clerk, Berkeley Chambers.

Hamilton.—Houses (52); burgh architect, Cadzow Street.

Harlow.—College of Further Education, first stage; David Chaston, Ltd., builders, Essex Road, Hoddesdon.

Hartlepool.—Twelve three-storey flats at Northgate; J. H. Wood, borough engineer.

Hemsworth.—Houses (58), on sites at Great Houghton, Ryhill and Shafton; S. Price, R.D.C. surveyor, Brierley Hall, Brierley, near Barnsley.

Hereford.—Works, Widemarsh Street; Saunders Valve Co., Ltd., Blackfriars Street.

Horsham.—Houses (30), on Needles Farm estate; U.D.C. surveyor, Council Offices, Horsham Park.

Houghton-le-Spring.—Houses (81), Burnside estate, and (88) Shiney Row; U.D.C. surveyor.

Jarrow.—Proposed health centre; county architect, South Street, Durham.

Extensions to factory, Bede trading estate, for Morganite Resistors, Ltd.; G. Henderson, Boldon Lane, East Boldon.

Keighley.—Flats (90), Braithwaite estate; borough architect.

Littleport.—Secondary modern school for Isle of Ely Education Committee; S. S. Ambrose & Son, Ltd., Ely, Cambs.

London.—Extensions to King's College Hospital Medical School, Camberwell; John Greenwood, Ltd., builders, 12, Arthur Street, E.C.4.

Reconstruction of Merchant Taylors' Hall, Threadneedle Street; Richardson & Houfe, architects, 24, Queen Anne Street, W.1.

Flats (70), Great Cumberland Place and Seymour Street, St. Marylebone; Ronald Ward & Partners, architects, 29, Chesham Place, S.W.1.

Maisonnettes (40), Crescent Rise, Wood Green; borough engineer.

Two-storey shops (18) with flats (50) above at Finchley Road, Hampstead; town clerk, Town Hall, Haverstock Hill, N.W.3.

Five-storey offices, 3-9, The Cut, Southwark; W. G. Edwards, chartered surveyor, 9, Blackfriars Road, S.E.1.

Flats (232) in Middle Park Avenue, Eltham; borough engineer, Town Hall, S.E.18.

Long Ashton.—Houses and bungalows (52), in Southfield Road, Nailsea, Somerset, for R.D.C.; M. Froud and Stevens, architects, 1, St. Stephen's Chambers, Bristol, 1.

Melford (Suffolk).—Houses (27), Great Cornard, for R.D.C.; Hughes & Bicknell, architects, Tunwell's Court, Trumpington Street, Cambridge.

Middlesbrough.—Boys' and girls' secondary high schools at Marton; K. J. Caton, education architect.

Middleton.—Houses and flats (38), Hollin estate; G. Syddall, borough architect, Town Hall, Middleton, Manchester.

Morecambe.—Casino at West End Park (£50,000); Joseph Emberton, architect, 17, Chantrey House, Eccleston Square, London, S.W.1.

Morpeth.—Houses (40), High Stanners, for T.C.; J. Dodds and Sons, builders, Dark Lane.

Newbiggin (Northumberland). — Houses (30), Bull Field site; H. W. Galley, U.D.C. surveyor.

Newburn (Northumberland).—Houses (46); J. A. Weatherley, U.D.C. surveyor.

Newcastle-on-Tyne.—Shops, showrooms, filling station, flats, maisonnettes, etc., Wingrove depot site, for Murray and Charleton, Ltd., motor dealers, College Avenue.

Newcastle (Staffs).—Crematorium at Bradwell; borough surveyor, Lancaster Buildings, High Street.

North Shields.—Three Methodist churches; W. Stockdale, Howard Street.

Norwich.—New central library (£175,000); D. Percival, city architect.

Penzance.—Flats (25), Newlyn (£38,000); borough surveyor, Municipal Buildings.

Peterborough.—Extensions to technical college; B. Stokeley, Ltd., builders, Eastfield Road.

Plymouth.—Factory extension; Fisons, Ltd., Cattedown Road, Prince Rock.

Rainham.—Factory in Warwick Road; Renown Flooring Co., 116, Park Road, Ilford.

Rowley Regis.—Houses (100), Tividale Hall estate; John Hilton, town clerk, Municipal Buildings, Old Hill, Staffs.

Rushden.—Houses and flats (50), Hayden Road site, for U.D.C.; A. G. Crowdy, clerk, Council Buildings.

Seaham.—Flats (100), Station Road and Dene House Road; A. M. Smith, U.D.C. surveyor.

Shevington (Wigan).—Bungalows (100), Coach House Farm estate, Old Lane; R. J. Barton & Sons, Ltd., building contractors, Brownmoor Lane, Great Crosby, Liverpool, 23.

South Shields.—Houses (90), at Norham Avenue and (26) at Garth Crescent; William Leech, Ltd., builders, St. James Street, Newcastle-on-Tyne.

Bungalows (88), Whiteleas; Whittall (Builders), Ltd., contractors, Pilgrim Street, Newcastle-on-Tyne.

Crematorium at West Simonside; John Reid, borough engineer.

Stanwell.—Happy Landing Hotel, adjacent to London Airport; Wilson Lovatt & Sons, Ltd., builders, 16, Grosvenor Crescent, S.W.1.

Stirling.—Swimming pool with plunge and Turkish baths (£150,000); burgh architect, 65, King Street.

Stratford-on-Avon.—New factory (32,000 sq ft), to have electrical installation preferably on busbar system; Peak Engineering Co., Ltd., New Street.

Three Bridges.—Bungalows (60); R. Green (Brighton), Ltd., 5, Pavilion Buildings, Brighton.

Trowbridge.—Houses (126) for U.D.C.; I. Evans, clerk, Town Hall, Trowbridge, Wilts.

Tutbury.—Houses and bungalows (62), Croft housing site; R.D.C. surveyor, Kingsley, Rolleston Road, Burton-on-Trent.

Tynemouth.—Houses at Murton (80), at Chirton (15); borough surveyor.

Uxbridge.—Flats (33), Vine Street; H. E. G. Stripp, borough surveyor, 263, High Street.

Walsall.—Factory in Rollingmill Street; Acme Conveyors, Ltd., Bradford Street.

Warwick.—New science block at Warwick School (£42,000); Rayner and Fedeski, architects, The Parade, Leamington Spa.

West Bromwich.—Factory, Bullock Street; W. Kendrick & Sons, Ltd., builders, Tasker Street, Walsall.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 30th June:—

PORTRIX. No. 748,654. Class 7. Electrically operated tools and tools for use therewith.—Portable Electric Tools, Ltd., 31, Sloane Street, London, S.W.1.

COLUMBUS (design). No. 749,325. Class 7. Scrubbing machines, machines for waxing floors, polishing machines, squeegee machines, machines for cleaning carpets and rugs, machines for oiling floors, machines for sanding floors, all being electrically operated and none for domestic use; and washing machines, polish spraying machines, drying machines and parts.—Rollnick & Gordon, Ltd., Capitol Works, Empire Way, Wembley, Middx.

DEJUR. No. B744,920. Class 9. Electrical apparatus and instruments, etc.—De Jur-Amsco Corporation, Long Island City, U.S.A. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

FARAS. No. 746,283. Class 9. Electrical apparatus and instruments; radio and television apparatus; radiograms, gramophones, record players, etc.; radio valves, loudspeakers, aerials, sound amplifiers, electricity conductors, resistors, condensers, insulated electric wires, cables; and electric switches and electric terminals.—Klang-Technik Böthner & Co., Berlin, Germany. Address for service, c/o O'Donnell, Livsey & Co., 47, Victoria Street, London, S.W.1.

UNIGARD. No. B748,574. Class 9. Electrical and electronic apparatus for controlling the operation of oil burning apparatus and for giving warning of failures in such apparatus.—Rheostatic Co., Ltd., 94, Farnham Road, Slough, Bucks.

SATURN. No. 750,385. Class 9. Electric welding apparatus.—Saturn Industrial Gases, Ltd., 50, Gresham Street, London, E.C.2.

LEWKANEX. No. 750,743. Class 9. Insulated wire, fuse wire and resistance wire.—London Electric Wire Co. & Smiths, Ltd., 24, Queen Anne's Gate, Westminster, London, S.W.1.

COMET. No. 750,116. Class 11. Electric ventilating fans.—Hillman Electric Motors, Ltd., 2-3, Northwold Buildings, Northwold Road, London, N.16.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Sunday, 24th June, to Tuesday, 26th June

EASTBOURNE. — Electrical Contractors' Association. Annual Conference.

Monday, 25th June, to Friday, 29th June

BIRMINGHAM. — Institution of Electrical Engineers. Summer meeting.

Wednesday, 27th June

LONDON.—Connaught Rooms, W.C.2, 12.0 for 12.50 p.m. Batti-Wallah's Society. Luncheon. Guest speaker, Mr. R. Fabian.

Management House, 8, Hill Street, W.1, 7 p.m. British Institute of Management. "The Automatic Factory," by J. F. Coales.

Wednesday, 27th June, to Friday, 29th June

LONDON.—St. Ermin's Hotel, Caxton Street, S.W.1. International Electric Tool Conference.